ENERGY, MINES AND RESOURCES CANADA
CANMET / CCRL

DESIGN OF AN ATMOSPHERIC RECIRCULATING FLUI[illegible]ED BED COMBUSTION RESEARCH FACILITY

VOLUME 1
DESIGN REPORT

JULY 1984

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Mr. D. Desai
Combustion & Carbonization
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Dear Sir:

Re: Final Report
ARFBC Research Facility Design
Contract Serial No. OSQ82-00224
DSS File No. 15SQ.23440-2-9141

We are pleased to submit herewith five (5) copies of our final report for the above contract. The report was prepared by INTEG-Intercontinental Engineering Ltd. and GA Technologies in accordance with the scope of work set out in Contract OSQ82-00224 and Amendments dated August 15, 1983 and March 1, 1984.

A draft report was presented in August, 1984 and most of the material has also been issued as milestone reports.

The report comprises four volumes, identified as follows:

Volume I - Design Report
Volume II - Equipment Specifications
Volume III - Bidders lists and Equipment Suppliers Quotations
Volume IV - Drawings

All drawings produced for this contract are included in Volume IV in reduced form for convenient reference, and the major drawings are included as well in Appendix II of Volume I for added convenience.

The design report includes a section which details the further work required to complete the procurement and final engineering of the facility. A recommended staged purchasing program is described which will facilitate the final engineering and minimize procurement delays.

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This report describes the second phase of the design of the ARFBC research facility. The first phase, prepared by others, was a conceptual design study. This phase encompasses the first part of the detailed engineering and includes development of the design to the tender stage and preparation of a detailed cost estimate. The information and drawings contained in this report are all subject to revision following procurement and receipt of certified equipment drawings and specifications.

We trust you will find the contents of the report to your satisfaction and will be pleased to offer any further assistance on this project.

Yours very truly,

INTEG-Intercontinental Engineering Ltd.

G.R. Cooper, P.Eng.
Project Manager

GRC/mt
c.c. E. Fresque D.S.S.

DESIGN REPORT

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SECTION 1.0

SUMMARY

1.0 SUMMARY

1.1 Organization

This report compiles the design of a pilot scale recirculating fluidized bed combustor and all auxiliary equipment for the CANMET Energy Research Laboratories in Ottawa. The design is a refinement of the conceptual design jointly prepared for EMR by Montreal Engineering/Pyropower Corporation. G.A. Technologies performed the detailed design of the combustor component and provided process design information for many of the ancilliary components under subcontract to INTEG.

The design is fully described in the drawings, the equipment specifications, and the design descriptions. The drawings include combustor details, mechanical, piping and civil/structural arrangements, as well as complete instrumentation and control and electrical specifications. These drawings are listed in section 6 and are bound in Volume IV, however the combustor detail and mechanical arrangement drawings are included in Appendix III of this volume for convenient reference. Complete specifications for major components of equipment are bound separately as Appendix V in Volume II. Specifications for electrical and I & C equipment are included on the drawings as are civil/structural specifications. Design descriptions are provided in sections 3 and 4 of this volume. Section 3 is a conceptual design description and provides a rationalization for the system design. Section 4 provides detailed component descriptions based on the mechanical specifications and the vendor responses. Equipment selection criteria are explained and the most favourable vendor responses summarized. These are hypothetical selections as no formal tender or proposal evaluations were conducted.

A complete cost estimate is included in section 7. This estimate is based on equipment costs derived from preliminary vendor enquiries and labour manhour estimates for installation. Major equipment prices from vendor proposals are summarized on the vendor proposal comparison sheets in Appendix IV.

Preliminary operating procedures are included in section 5. The operating philosophy and general instructions only are given. Complete instructions can be prepared after equipment selection has been finalized.

Section 8 contains a description of the work to be done to complete the project. This phase of the design ends at the preliminary design drawing and equipment specification stage. Equipment procurement, final design drawings and materials lists must be completed in the next phase. A recommended staged procurement program is included as well.

Vendor proposals received in response to the enquiries on the major equipment are bound as Appendix VI in Volume III, along with bidders' lists for each component.

1.2 Facility Design

The facility is a pilot scale recirculating fluidized bed combustion research facility. The facility is complete, from fuel, sorbent and air inputs to ash and fluegas effluent systems, and includes supporting and access structures as well as full instrumentation. The specification and arrangement of major equipment was designed for maximum versatility and flexibility because of the research nature of the facility.

The process design is based on two specific fuels: tarsands fluid coke as the maximum performance fuel, and coal washery rejects as the minimum performance fuel. The materials handling systems, however, were designed to accommodate a wider range of materials, including wood chips and peat.

The combutor design is based on the design of the existing GA Technologies pilot plant, with some input from open literature design information for circulation of solids. The preliminary design of the critical L-valve component was tested on the GA pilot plant and subsequently revised.

The fuel and sorbent bin charging systems were carefully studied in order to ensure they were provided with maximum flexibility and operating simplicity. The systems specified will handle all anticipated materials but operating simplicity has to some extent been sacrificed in the interest of this flexibility.

The cooling system includes process coolers in the combustor, flue gas ducting, bottom ash drain and direct fuel feed screw, as well as a circulating water cooler. The water cooler was studied in order to minimize winter freezing problems, and the specified system is an evaporative cooling tower equiped with an external heat exchanger and a remote sump tank. This cooler system will be installed in a separate structure outside the existing building, freeing up substantial space in the ground floor operating area of the facility.

The equipment is arranged for maximum operating and maintenance accessibility. The facility is to be located in a 7m by 7m area in the south-east corner of the coal storage room in building 2 of the Energy Research Laboratories. Area platforms are provided for access to all levels of the facility, although some equipment is located out of the designated area. The forced draft and limestone blowers are located on an existing mezzanine level in the same room to the south of the area, and the induced draft fan and stack are located on a new platform to be built in the adjacent garage area to the east of the designated area. It is anticipated that the control room will be installed on a new platform also to be built in the garage area. A penthouse structure is to be constructed on the building roof to house the combustor bayonet cooling tubes in their retracted position.

1.3 Costs

The estimated cost for the entire facility, exclusive of some work beyond the scope of this contract and final engineering, is $1,452,526. This cost is based on suppliers equipment prices and engineering estimates from the design drawings. An itemized total cost estimate is included in the report along with an itemized equipment cost estimate organized into recommended priority stages for procurement purposes.

1.4 Further Engineering Work

This is the second phase of the design of the facility - the first phase was the conceptual design study, and the next phase is final engineering. Final engineering includes procurement, revision and updating of drawings and specifications and preparation of final operating instructions. As well, a number of tasks initiated by EMR but beyond the scope of this contract include construction of an enclosure for the cooling tower, construction of platforms at elevations 4,700 and 7,620 in the garage area including access doorways through to the combustor area platforms, construction of a control room, construction of an acoustic barrier wall on the existing mezzanine floor and modifications to the platform and landing of the existing coal bunkers where they interfere with the new combustor platforms.

SECTION 2.0

INTRODUCTION

2.0 INTRODUCTION

2.1 Authorization

This report has been prepared jointly by INTEG-Intercontinental Engineering Ltd. and GA Technologies for the Department of Energy, Mines and Resources under DSS contract OSQ82-00224, DSS File 15SQ. 23440-2-9141, dated January 19, 1983.

2.2 Scope of Work

The scope of work conforms to that outlined in the DSS contract and our proposal document of November 26, 1982.

The work consists of the design of a pilot scale recirculating fluidized bed combustor with all ancillary equipment for the CANMET Energy Research Laboratories. The design includes all necessary drawings, specifications, descriptions, operating procedures and cost estimates to take the design to the procurement stage. Fabrication drawings are not included as these should come from vendors during the procurement stage.

2.3 Methodology

A conceptual design, commissioned earlier by EMR and performed by another consultant, formed the basis for the design. After award of this contract, INTEG awarded a subcontract to GA Technologies for process design and detailed design of the recirculating fluidized bed combustor component.

Specifications were prepared for major equipment components and a preliminary vendor proposal survey was used as the basis for the bayonet and piping drawings and the cost estimate. INTEG worked closely with EMR and GA in order to develop a very practical and versatile research facility design.

SECTION 3.0

DESIGN CONCEPT

3.0 DESIGN CONCEPT

3.1 General

A conceptual design was previously developed and described in the conceptual design study report entitled "Atmospheric Recirculating Fluidized Bed Combustion Pilot Plant Conceptual Design Study", completed in September, 1982 by Montreal Engineering. This study was prepared in cooperation with Pyropower Corporation, and illustrated a conceptual plant design based on the Pyroflow recirculating fluidized bed combustor, originally designed by the Ahlstrom Corporation of Finland and marketed by Pyropower. This study formed the basis for the design concept eventually adopted.

The concept was further refined at a meeting held in the offices of GA Technologies in San Diego, California, on 1 March 1983. The final design criteria were developed at this time.

Plant performance is based on two specified fuels, selected by CANMET as the maximum and minimum calorific value fuels that would be tested in the combustor. Wood chips and peat, although considered in the design of the materials handling system, are not considered in the performance rating of the equipment.

Design basis fuel specifications are included in Table 3.1.

3.2 Material and Energy Balances

Material and energy balances giving expected plant performance on maximum and minimum design basis fuels are given in Tables 3.2 and 3.3. The balances are referenced to Figure 3.1, Process Flow Schematic.

The base criteria for the material and energy balances are as follows:

- Design basis fuel properties
- 7.0 m/s superficial combustor gas velocity
- 25% excess air (corresponding to 1,100°C uncooled combustor temperature)
- Combustor cooling at maximum of 65% of fuel heat input
- Ca:S ratio set at 2.3
- No baghouse flyash recycle
- Ash distribution of 60% bottom ash and 40% flyash

The design limestone feed rate for the maximum CV fuel was set using the following assumptions:

- 9% sulphur in fuel
- maximum SO_2 0.7 kg/MkJ (1.64 lb/M Btu)
- 90% $CaCO_3$ in limestone
- Ca:S ratio of 2.3

3.3 Combustor

The combustor configuration is a recirculating type with external cyclone and valveless seal. This configuration was chosen to exploit its capability to burn low calorific value, unreactive and high sulphur fuels. The shape and construction of the combustor were selected and discussed in the conceptual design study and were adopted for this phase.

The combustor dimensions of 400 mm internal diameter by 7200 mm high were selected during conceptual design as a reasonable compromise between capital and operating costs and reliable extrapolation of test results to full scale. The combustor diameter is reduced to 300 mm for the bottom 600 mm of combustor height in order to maintain reasonable minimum fluidization velocities during low turndown operation.

The loop seal design was based on open literature and was modified slightly following verification testing on the GA Technologies 400 mm diameter ARFBC pilot plant. The results of this testwork are included in Appendix III.

Bayonet Cooling Tubes

Combustor bed cooling is provided in the form of four retractable bayonet tube heat exchangers which penetrate the combustor longitudinally from the top. The bayonet tubes are sized to extract 0-65% of the heat released, depending upon the depth of penetration into the combustor and the number of tubes in service. The bayonet tube heat exchanger was selected because it provides good heat exchange surface while limiting combustor shell penetrations. The longitudinal bayonet tubes also offer minimal flow disruption and should suffer only minor abrasion problems due to this configuration. The problem with this approach is obtaining adequate overhead clearance for retracting the tubes. The combustor is long and the tubes, in order to reach the hottest section of the bed (which is near the fuel inlet), are also long. Consequently, an extension to the roof of the building is required in order to fully retract the tubes.

Ignition Burner

Ignition is effected by a manually controlled propane/natural gas fired start-up burner, sized to preheat the combustor with a mildly fluidized sand bed to the fuel ignition temperature of 800°C in one hour. The burner is also intended to be used temporarily during operation of the combustor in order to maintain temperature upon loss of fuel supply or support combustion. The burner will be mounted on a nozzle angled downward at 30° at the elevation of the fuel inlet, and will be capable of operating against a combustor backpressure of 35 kPa(g).

Bed Drain

Ash is removed through a 75 mm diameter penetration entering the combustor just above the distributor nozzles. This ash, at combustor bed temperature, must be removed from the combustor for safe disposal. Because of overhead clearance constraints, the combustor must be located as low to the ground as possible, which limits the options for bottom ash removal. For this reason an inclined water cooled screw conveyor has been chosen. The conveyor shaft, flights and trough will be water jacketed to effect the greatest possible heat transfer. Maximum inclination for operation of a screw conveyor with bottom ash is 15 degrees, and that, coupled with the required clearance for dumping into a standard drum, has set the elevation of the combustor.

Fuel Feed

Two modes of fuel feed are provided: over bed and in bed. Fuel is fed into the bed via a 100 mm diameter pipe sloped downward at 60 degrees. This feed point will be used for coke and most coals. Fuel is fed over the bed by a water cooled screw feeder penetrating through the combustor wall. Wood chips and coking coal will be fed in this manner.

3.4 Materials Handling

The materials handling system encompasses the receipt, conveying, storage and metering of fuel, sorbent and sand, as well as the reinjection of flyash from the dust collector. The system is shown schematically in Figure 3.2.

The variable properties of the designated fuels (as given in Table 3.3) requires wide rangeability from the materials handling system. Turndown ratios for variable speed equipment are generally specified at 20:1, and conservative sizing criteria have been applied in selection of most equipment.

Versatility is featured throughout the design of the materials handling system because of the wide variation in material properties and flow rates. Since this is a research facility, flexibility has in some cases taken priority over simplicity (for example, the fuel loading system discussed below).

Fuel System

The fuel system accomplishes the loading of prepared fuel into the fuel storage bin. Fuel is received and prepared for operating trials in another part of the laboratory, then loaded into portable covered hoppers and transported to the combustor area. Alternatively, coal and coke could be unloaded into some of the 6 existing 9 tonne coal bunkers using the existing bunker loading system which accepts the material from the garage area. The portable hoppers would then be filled beneath the bunkers and rolled over to the bucket elevator.

Fuel from the 700 kg capacity bucket elevator loading hopper is discharged into the bucket elevator and conveyed into the bin. The design specifies a bucket elevator mounted at the ground floor elevation which will require the loading hopper to be hoisted to a loading platform above the inlet spout in order to feed the bucket elevator. Approximately three hopper loads will be required to fill the bin with coal rejects due to limitation on hopper height, dictated by clearance beneath the coal bunker discharge valve.

Alternatively the fuel bin can be filled directly by discharging into the top of the bin from the 440 kg capacity fuel bin loading hopper, which is positioned above the fuel bin alternative loading opening by the overhead crane. This hopper, size constrained by limited clearance between the crane hook and the top of the bin, will require 6 loads to fill the bin with coal rejects. It is anticipated that this method would be used if the bucket elevator is unavailable or the fuel not suitable for it.

Alternative methods of loading the fuel bin using a pneumatic conveying system were also studied. Three different system types were considered: vacuum, pressurized and pressurized-vacuum combination (push-pull) systems. The results of this study are included in Appendix I. The pressurized system was deemed the most favourable pneumatic option, but the bucket elevator system was selected because of possible material property constraints (maximum size, moisture content, etc.) and possible undesirable size segregation with a pneumatic system.

The bucket elevator is sized to fill the 1,800 kg fuel bin in 30 minutes at a rate of 1 kg/s on coal rejects. The bin is sized to provide sufficient coal rejects fuel for 6 hours operation between refillings.

Consideration was given to providing a removable bin, which could be disconnected and hoisted down to the ground floor for filling. This was impractical as the weight of the loaded bin would exceed the capacity of the crane and the bin would have to be taken away for filling as it would not fit beneath the coal bunker discharge gate.

CANMET has expressed an interest in installing the bucket elevator in a pit, thereby eliminating the requirement for the crane to hoist the bucket elevator loading hopper. This is not in the scope of this design, but should be considered during final engineering.

Fuel is metered from the bin by a variable speed belt type weighfeeder which accurately controls the flow of fuel to the combustor. The weighfeeder instantaneously feeds and weighs and was selected over a volumetric feeder with weighscale due to the high accuracy, continuously totalized readout and reasonable cost inherent in this design. Feed rate can be controlled by a manually selected setpoint or a process control signal. A vibrating bin discharger is provided to promote material flow to the weighfeeder.

A constant speed rotary airlock and a manually operated diverter gate sampler are located at the discharge of the weighfeeder. The airlock is necessary to isolate the weighfeeder from hot combustion gases which may be present due to backflow in the feed system.

Sorbent System

The sorbent system accomplishes the loading of sorbent (primarily limestone) into the limestone storage bin. Limestone is transported to the loading area in steel drums or in one of the larger portable loading hoppers. It is possible that one of the existing coal bunkers could be used for limestone also, but some material contamination would occur due to the common bunker loading system.

A vacuum type pneumatic conveying system is used to transport limestone from the hopper or drum to the bin. A suction lance is manually manipulated at the intake end and material is discharged from a cyclone separator with rotary airlock into the limestone bin. The pneumatic system was selected as it is best suited to the fine dry material and would minimize dusting problems resulting from system leaks. There is also alternative provision to fill this bin from an auxiliary port on the top of the bin.

The loading system is sized to fill the 800 kg capacity bin in 70 minutes. The loading rate and bin size were both constrained by the maximum height allowable under the crane hook. The bin capacity is sufficient for about 18 hours operation on coal rejects.

Limestone flow is metered by a constant speed belt type weighfeeder which is fed by a variable speed screw prefeeder to a demand signal from the weighfeeder. This scheme is different from the fuel metering system due to the fineness of the limestone. Although the screw prefeeder is intended to prevent possible flooding of the material onto the weighfeeder, a vibrating bin discharger is also provided to ensure continuous flow in case the material bridges in the bin.

A rotary airlock and sampling gate are located at the weighfeeder discharge.

Combustor Feed

Material from the fuel and sorbent weighfeeders is collected in a horizontal screw transfer conveyor which transports it to the combustor. The transfer conveyors will be equipped with three inlets: for fuel, limestone and sand.

Sand is hoisted above the transfer conveyor in the portable sand loading hopper and discharged into the transfer conveyor for initial charging of the bed. Alternatively, sand can be discharged into any of a number of combustor openings that may be available (such as secondary air port, observation port, etc.).

Two interchangeable transfer conveyors are provided: No. 1, which feeds by gravity through a rotary airlock and 100 mm diameter inclined chute into the combustor bed, and No. 2, which feeds directly through the combustor wall above the bed. Only one of the conveyors can be in place at any time.

The primary mode of feeding will be in-bed using No. 1 transfer conveyor. The system is isolated from combustor backpressure by a rotary valve at the conveyor discharge, tight manual gates at each conveyor feed inlet and additional rotary valves at the discharge of each weighfeeder. The conveyor is also equipped with a manually controlled variable speed drive to keep the screw as full as possible to further assist in sealing. This conveyor will be used for most fuels, including coke and most coals.

No. 2 transfer conveyor will be installed beneath No. 1 conveyor after it has been removed. Adapter chutes will be installed from the weighfeeders to inlet flanges on No. 2 conveyor. In order to protect the conveyor from the high temperature in the combustor, the last third of the screw and shaft will be fabricated in stainless steel and the combustor end of the casing will be water jacketed. The screw is of larger diameter to accommodate large wood chips, etc. and reverts to half pitch over the last third in order to effect a partial seal against combustor pressure. This conveyor will also be equipped with a variable speed drive, and will be primarily used for wood and peat and coking coal.

The inclined feed chute will be partially removed and blanked off when No. 2 transfer conveyor is installed. This chute will be generously purged with cool air to offset the effects of combustor pressure and temperature.

Flyash Recycle

Flyash collected in the baghouse hopper can either be collected in a storage drum or pneumatically reinjected into the combustor. Material is metered by a variable speed rotary valve into the conveying line airstream. Conveying airflow can be controlled by manual adjustment of the flyash recycle control valve, and a 3 way pneumatically operated diverter valve is used to select flyash reinjection or collection in the sample drum. No reliable means are provided for measuring recycle flow, but it could be estimated knowing the flyash production rate, rotary valve speed and recycle air flow.

Possible connection of the flue gas cooler ash to the flyash reinjection system could be examined during final design.

Ash Collection

Combustor ash is collected in steel drums from three locations: bottom ash is collected at the bed drain cooler discharge and flyash is collected from the bottom of the flue gas cooler by gravity and from the baghouse pneumatically.

Approximately 3 drum loads of cooled bottom ash should be collected per 8 hour shift when operating on coal rejects (approximately half a drum on fluid coke). This drum will therefore have to be changed several times a shift for some fuels. There is a possibility that the baghouse drum will also require changing during a shift, depending on fuel ash content and flyash recycle rate.

The baghouse sample drum must be sealed and equipped with a filtered vent.

3.5 Air System

The air system provides air for fluidization and combustion, combustor loop seal purge, ignition burner combustion, baghouse fly ash recycle pneumatic conveying and purges. The system is shown schematically in Figure 3.3.

Air is delivered at constant volume and pressure by the positive displacement forced draft blower. The blower will draw filtered outside air and is the sole source for all combustion air. Air distribution is approximately as follows:

FLOW	NORMAL	RANGE
Primary	45%	40 - 100%
Secondary	50%	0 - 60%
Loop Seal	5%	0 - 5%
Flyash Recycle	Part of Primary	
Ignition Burner	Part of Primary	

A large flow margin of 60% over design basis performance requirements is provided to ensure adequate performance under nearly all operating conditions. Air flow is controlled by automatic butterfly valves for all the major flows and pressure is controlled by the pressure regulating bypass vent. A fixed flow orifice is provided to reduce the pressure of primary air.

Secondary air can be admitted to five different levels in the combustor. Overall secondary airflow is controlled automatically, but flow to the individual nozzles is controlled manually at individual diaphragm valves and observed at a rotameter station. Loop seal air flow is also automatically controlled but manually directed at the three inlet nozzles.

3.6 Cooling System

The cooling system is designed to provide cooling for the combustor, fluegas prior to admission to the baghouse, bottom ash prior to discharge and the direct feed (No. 2) transfer conveyor. Water is circulated through the process cooling equipment and then back through a heat exchanger to maintain a constant water supply temperature. The heat exchanger is cooled in turn by an open evaporative cooling tower. The system is shown schematically in Figure 3.4.

The cooling system consists of the following components:

- Bayonet tube heat exchangers
- Flue gas cooler
- Bed drain cooler
- Water jacketed No. 2 transfer conveyor
- Heat exchanger
- Cooling tower
- Pump and piping

The bayonet tube heat exchangers are sized to remove 65% of the heat liberated in the combustor during maximum design basis operation. Performance is normally controlled by adjusting the depth of penetration of the 7,165 mm long tubes in the combustor. Normal penetration is 5,490 mm from the top (1,220 mm above the distributor plate), but can be adjusted from a maximum of 6,100 mm to the minimum fully retracted position. This method of control will require the FD blower to be shut off to effect any changes, so a temperature control valve is provided to allow a limited amount of automatic control. Significant throttling of flow to the tubes is not desirable due to the possibility of hot spots developing that could lead to tube ruptures. A wire rope suspension system and a hand operated winch are provided for manipulating bayonet tube penetration.

The flue gas cooler is a water to gas heat exchanger, designed to cool the gas to a safe temperature for the bag material in the baghouse. Hot gas (up to 1,000°C) from the cyclone outlet is cooled to 177°C, considered low enough for the baghouse materials but above the acid dewpoint of the gas.

Performance control is important for this heat exchanger also, in order to maintain the gas temperature above the acid dew point (estimated to range between 120 to 150°C for high sulphur fuels). The cooler will provide for isolation (or removal) of 30 to 50% of the cooling surface and is also equipped with a temperature control valve on the water return line for limited flow attenuation. As well, a bypass is provided to route cool flue gas around the cooler and the baghouse during startup conditions. A wide variety of heat exchanger types were considered and no selection was made at this time, although the arrangement drawings show a shell and tube exchanger.

The bed drain cooler is designed to cool the combustor bottom ash to a safe temperature (150°C) for disposal. This will be a tube type screw conveyor with hollow water cooled shaft and flights and water jacketed trough. Conveyor speed is controlled by a variable speed drive and water flow is controlled by a globe valve at the water outlet.

No. 2 transfer conveyor is a water jacketed screw conveyor which extends into the combustor wall and is cooled to protect the conveyor against the high combustor temperatures. Temperature is controlled by a globe valve at the cooling water outlet.

A cooling tower is provided to maintain the circulating cooling water at the supply temperature of 29°C. A design study was conducted to select from among several cooling tower alternatives, including an evaporative closed circuit cooling tower, a dry air cooler and an open circuit cooling tower with external heat exchanger. The results of this study are included in Appendix I. The latter option was selected due to the smaller evaporative system for the same performance and lower cost.

The circulating water is cooled in closed circuit in the heat exchanger, which is cooled by the open cooling tower. To reduce freezing problems during cold weather operation, the cooling tower drains to an external sump away from the outside airstream. When the cooling tower is not operating the tower will be isolated by positive closing louvers at the air inlet and outlet.

An automatic control system will maintain the circulating water temperature during all ambient conditions. The cooling tower spray system is always operated at constant flow, but as the ambient temperature drops, fan capacity control dampers will divert airflow from the heat exchange surface, and finally the fan will be shut off in order to maintain the desired circulating water temperature. Further control is affected by partial bypass of circulating water around the heat exchanger.

The circulating water temperature is regulated between the 29°C supply and the 66°C return temperatures. 29°C was selected as the lowest reasonable temperature attainable in summer without resorting to refrigeration cooling, and 66°C was considered to offer the highest reasonable temperature differential without risking excessive pressures at hose connections and boiling in the bayonet tubes.

Calculated cooling system water requirements are given in Table 3.5.

3.7 Flue gas System

The flue gas system conveys products of combustion from the cyclone to the stack and comprises breeching, baghouse, induced draft fan and stack, and includes the flue gas cooler. The flue gas system is shown schematically in Figure 3.5.

Flue gas breeching from the cyclone to the flue gas cooler is refractory lined because of the high gas temperatures in this section. The refractory lining is designed to limit the external shell temperature of the duct to 93°C. Expansion joints are provided to absorb thermal expansion in critical locations. After the cooler, breeching is fabricated from carbon steel with insulation applied to the exterior to maintain a skin temperature of 71°C. A separate breeching is provided around the cooler and around the baghouse to permit bypass of these components during startup and shutdown. This breeching will be insulated carbon steel and will be used up to a maximum flue gas temperature of 260°C.

The flue gas cooler, previously described in section 3.6, is designed to cool the hot flue gas to 177°C, and so defines the interface between refractory lined and insulated breeching. Expansion joints are provided at the inlet and outlet to absorb thermal strain and the cooler will be insulated for personnel protection. The bypass is provided to prevent acidic condensation and accumulation of wet and sticky particulate during low temperature (less than 260°C) combustor operation, such as occurs during startup and shutdown. A hopper bottom and flyash discharge system are provided to remove larger flyash particles that may drop out after impinging on the heat exchange surface.

The baghouse is designed to collect entrained flyash particulate from the flue gas. Filter bags will be resistant to temperatures of 177°C and peaks to 260°C for one hour duration and a filter cloth to air ratio of 3.5:1 has been specified. Bags will be cleaned by an automatic pulse jet system and flyash collected in the baghouse hopper for disposal as discussed in section 3.4. Final baghouse selection may be dictated by layout constraints due to access, platform locations, as well as the flue gas breeching and pneumatic reinjection piping system.

The ID fan imparts sufficient energy to discharge the flue gas from the stack at an outlet velocity of 15 m/s. The balanced draft point is at the combustor outlet and the flue gas system is under negative pressure from there to the ID fan. Fan performance is controlled by a modulating fan inlet damper controlling to this balanced draft point.

The stack is designed to disperse the combustion effluent to the atmosphere. A double shell insulated design was selected, which extends 9,150 mm above the top of the building - sufficient to safely clear the roof penthouse. A stack gas sampling penetration is provided at a distance 8 stack diameters (2,440 mm) from the flue gas inlet. This is considered the required positioning for accurate isokinetic gas sampling, but the penetration must then be located on the roof. Further consideration may be required on the location of this penetration.

3.8 Control Philosophy

The purpose of the control system is to control variable input parameters to the combustor system while measuring various output parameters, in order to assess the performance of the process while ensuring safe and reliable operation. This is done by controlling the feed rates of fuel, sorbent, air and such parameters as flue gas pressure and cooling water temperature.

Additional monitoring of flows, temperatures and pressures will be provided to give a complete description of the plant operation. The control system will provide all necessary alarms and protections.

Instrumentation and control will be provided for the following plant subsystems:

- ignition burner (independent package)
- fuel feed
- sorbent feed
- forced draft air
- loop seal air
- cooling water circuit
- I.D. fan (combustor pressure)
- fly ash recycle air

There will be four basic functions of the control system: control, alarm, monitoring and protection.

Control

The control function maintains different variables in the plant by regulating and/or sequencing the associated equipment in response to operator commands and automatic control signals.

There will be two basic types of control, Logic control (interlocks) and Modulating control. Logic control will initiate pre-planned actions (on/off or open/close) to simplify operator involvement. Modulating control will regulate the process at a required set point of operation.

Logic control will provide interlocking and sequencing for the following equipment:

- ignitor and F.D. air pressure
- I.D. and F.D. fans
- fuel and sorbent feeders and associated conveyors and rotary valves

Modulating control will regulate the following process parameters:

- fuel flow
- fuel to total air ratio
- air to fuel ratio (cross limiting ratio)
- secondary air to total air ratio
- sorbent to fuel ratio
- flue gas pressure (system draft)
- cooling water supply temperature and pressure
- remote sump level
- combustor cooling water outlet temperature
- flue gas cooling water outlet temperature
- combustion air pressure

The modulating control functions will be implemented on programmable microprocessor based controllers. Logic and interlocking functions will be implemented in relay logic at the MCC or DC drive controllers cabinet.

Alarm, monitoring and protection functions will be segregated from each other as far as possible, such that failure of one function does not result in a failure of any of the other functions.

Alarm

An alarm advises the operator of a malfunction in the plant and requires him to take action. The alarm function will be used as a means of keeping critical equipment conditions and process parameters under constant surveillance.

Monitoring

The monitoring function provides the operator with historical and real time information which is used to evaluate and control plant performance. The information will be presented to the operator through indicators, recorders, the data logger, the shared controller display and status lights.

Protection

The protection function takes direct action to minimize the effect of hazardous conditions on equipment faults before they can cause damage or jeopardize the safety and availability of the plant. The protection function takes action directly overriding all other control instructions. The operator is advised to what extent a protection action has been taken, via the monitoring and alarm functions. The protection function will be initiated by any one of: combustor high pressure, combustor high average temperature, F.D. blower trip, I.D. fan trip, primary air flow low, control system power failure, or both master trip pushbuttons being pressed. The protection function will be executed by an immediate fuel trip.

Alarms will be implemented by alarm windows located on the upper portion of the control panel. All alarms will have an audible signal system which will alert the operator.

The protection function will be implemented on the microprocessor based controller. System will be fail safe such that as power loss to controller, a fuel trip will be initiated.

The flue gas analyzers and recorders are out of scope and will be provided by EMR.

The monitoring system shall be designed to make use of a 48 point data logger (eg: Kaye Instruments Digistrip III) also to be supplied by EMR. The controllers shall be capable of being interfaced to a communications console (CRT display).

Control signals to the field and transmitter signals from the field will be 4-20 m ADC. Signals between panel instruments will be either 4-20 m ADC or 0-10 VDC. Pneumatic signals (in the field only) will be 20-100 kPa. All control valves will be supplied with diaphragm actuators with fail position (on air or control signal failure) selected on the basis of safety considerations.

3.9 Layout

The research facility is to be located in Building 2 of the EMR Combustion and Carbonization Research Laboratories. A 7 by 7m space has been allocated in the south-west corner of the existing coal storage room, adjacent to the garage.

This location is constrained in many areas, limiting flexibility in layout of the equipment. The allocated space borders building walls on the east and south and an array of existing coal bunkers to the north. This leaves the west side as the only accessible one, forcing location of all equipment requiring operating or maintenance access to this side. A further constraint is imposed by the elevation of roof steel at 11 m above the floor.

Equipment has been arranged to maximize access and utilization of the available space. The combustor, fuel and sorbent bins, transfer conveyors and baghouse are accessible from the open side to the west. The cyclone and flue gas cooler are located as close as possible in order to minimize the length of hot (refractory lined) flue gas ducting.

At EMR request, large and noisy equipment is located out of the allocated area. The cooling tower, heat exchanger, sump and pumps are located in a separate enclosure outside the east wall of the garage. The forced draft and limestone blowers are located on the existing mezzanine floor to the south of the allocated space. The ID fan and stack are located on a new platform to be constructed in the garage area at elevation 7,622 mm. While no location has been established at this point for the control room and electrical motor control center panel, EMR is considering the installation of another platform for them in the garage at elevation 4,700 mm.

The combustor length of 6.7 m was determined during the conceptual study. The elevation of the combustor is determined by the length plus the necessary clearance beneath it to discharge bottom ash into a standard drum, resulting in a top elevation of 8.6 m (disregarding the retracted bayonet tubes). A roof opening and penthouse structure are then required to accommodate the full retraction of the 7.2 m long bayonet tubes and to support the tube suspension system.

The elevations of the remaining equipment are related to the elevations of the various combustor penetrations. Of special note is the bucket elevator, as this is the highest structure (at elevation 9,440 mm) located beneath the normal travel of the overhead crane, and therefore restricts the maximum allowable size of the crane. The bucket elevator must be high enough to discharge into the fuel bin, the height of which is determined by:

- The necessary height of the bin for the volume contained (considering optimum hopper discharge angles),
- The height of the bin discharge equipment and the No. 1 fuel transfer conveyor,
- The height of a rotary airlock and expansion joint above the combustor fuel chute.

It should be noted that all layout details are based on an assumed equipment selection. The layout drawings will require confirmation and revision following receipt of actual vendor certified dimension data during final engineering.

Platforms and stairs are specified to provide ample access to all equipment. Where possible the platforms, which generally span the entire allocated area, were tied into existing platforms and floors to provide alternate access routes. The following main platforms are provided:

1) Elevation 2,700:
    - First platform
    - Elevation is a compromise between ground floor headroom and access to combustor viewing port, feed chute, ignition burner, No. 2 transfer conveyor and bucket elevator loading platform
    - Access via stairs at west side.

2) Elevation 4,700:
   - Second platform
   - Aligned with existing mezzanine floor
   - Provides access to No. 2 transfer conveyor, fuel and limestone weighfeeders and the baghouse, as well as the forced draft and limestone blowers on the mezzanine floor
   - Access via stairs at west side and the mezzanine floor.

3) Elevation 7,770:
   - Third platform
   - Aligned approximately with the upper platform at the existing coal bunkers
   - Provides access to the tops of the combustor, fuel and sorbent bins, and bayonet tube seal clamps and retraction winches
   - Access via stairs at west side and coal bunker platform stairs. (It should be noted that this platform will interfere with existing coal bunker upper platform, necessitating some modifications to that platform).

4) Elevation 11,075:
   - First penthouse platform
   - Aligned with the building roof
   - Provides access to the bayonet tube water hoses
   - Access via steel ladder to the floor below and to the roof via an outside door.

5) Elevation 14,400:
   - Second penthouse platform
   - Provides access to the bayonet tube suspension system
   - Access via steel ladder to the platform below.

6) Elevation 3,000:
   - Cooling tower access platform
   - Located in the cooling tower enclosure and provides access to and supports the cooling tower above the remote sump
   - Access via steel ladder from the ground floor.

Two additional platforms, specified by EMR well into the design stage, are not included in the scope of this contract but are described as follows:

1) Elevation 4,700:
   - Located in the garage at the elevation of the mezzanine floor, and spans between the mezzanine floor and the lower platform of the existing coal handling structure
   - Provides area for control room and electrical panel
   - Access via stairs at the existing platform, mezzanine floor and via a new door to the main platform.

2) Elevation 7,620:
   - Located in the garage at the elevation of the upper platform of the existing coal handling structure
   - Provides support for the ID fan and stack
   - Access via stairs at the existing platform and possibly also via a new door through to the main platform at el. 7,770.

EMR is considering the installation of an acoustic barrier wall along the north edge of the mezzanine floor in the existing coal storage room. The FD blower is specified with an acoustic hood regardless, although the wall is intended to isolate the noise of an existing building air handling unit. It is possible that the new wall can be designed to enclose only the existing noisemaker, otherwise the wall should be provided with an access door to the platform at el. 4,700.

The design of the cooling tower enclosure is also out of the scope of this contract, but a description will be provided. The enclosure is an insulated cladded steel frame structure, extending from the ground floor slab to the top of the existing building. The existing man door from the garage will be used for direct access to the existing building and larger equipment doors will be included for outside access. Automatic intake and exhaust louvers, painted to match the cladding, will be installed on the east wall. The ground floor will contain the external sump, heat exchanger, pumps and most of the piping. The cooling tower will be located on a steel platform above the sump, and will be equipped with a discharge duct connected to the outlet louver. Although the two louvers are automatically controlled to open only when the tower is operating, is recommended that heating be provided for this enclosure for standby periods when the tower is not in operation but will have water in the system. An electric immersion heater could also be provided for the sump.

EMR will provide an overhead travelling crane to primarily service the fuel loading and exchanging of the transfer conveyor operations, as well as routine maintenance tasks. The crane rails will span baylines 14B to 15A (a total of 7.1 m north-south) and the crane bridge girder will span baylines N to P (7.3 m east-west). Removable travel stops are to be provided on the crane rails to prevent the crane from travelling into the bayonet tubes and tube support wires.

Removable grating sections are provided on the platforms at elevations 7,770 and 4,700 to permit crane access to the transfer conveyors.

An additional crane may be required for the flue gas cooler tube bundle, but this must be determined during detailed engineering.

TABLE 3.1 - DESIGN BASIS FUEL PROPERTIES

		MINIMUM	MAXIMUM
PROXIMATE ANALYSIS	(As Received)		
Moisture	%	20.1	3.6
Volatile matter	%	N/A	7.0
Fixed carbon	%	N/A	83.0
Ash	%	53.5	6.4
Higher heating value	kJ/kg	6,849	31,263
ULTIMATE ANALYSIS			
Sulphur	%	0.10	6.80
Hydrogen	%	3.76	1.20
Carbon	%	17.76	79.50
Nitrogen	%	0.38	1.20
Oxygen	%	24.50	2.50
Vanadium	ppm	-	1,700
Unaccounted	%	-	2.40
Ash	%	53.50	6.40
Ash fusion temp.	°C	1,280	1,370
SIZE DISTRIBUTION	(By Weight)		
50 mm - 38 mm		-	-
38 mm - 25 mm		-	-
25 mm - 19 mm		-	-
19 mm - 13 mm		3.04	-
13 mm - 6 mm		20.20	-
6 mm - 3 mm		28.34	-
3 mm - 16 mesh		16.90	-
16 mesh - 100 mesh		9.52	-
28 mesh - 100 mesh		22.00	-
100 mesh - 0		-	100

NOTE: Minimum and maximum denote minimum and maximum calorific value design basis fuels. Properties for minimum CV fuel is taken from Stercoe No. 3 Heavy Medium Cyclone Reject Coal and maximum CV fuel from Syncrude Fluid Coke.

TABLE 3.2 - MATERIAL AND ENERGY BALANCE - MAXIMUM CALORIFIC VALUE FUEL

STREAM	DESCRIPTION	MASS FLOW (kg/s) (1)	VOLUMETRIC FLOW		TEMPERATURE (°C)	PRESSURE (kPa - abs.)	DENSITY (kg/m^3) (7)	HEAT CONTENT (kW) (4)
			(Am^3/s)	(l/min)(7)				
1	Fuel (2)	0.023	N/A		21	101.4	800 (3)	724
2	Limestone	0.012(8)	N/A		21	101.4	1600 (3)	(-1)
3	Total FD Air	0.280	0.160		57	170.4	1.75	16.1
4	Secondary FD Air	0.140	0.112		57	122.1	1.25	8.0
5	Primary FD Air	0.126	0.096		57	127.5	1.31	7.2
6	Loop Seal Air	0.014	0.008		57	153.2	1.82	0.3
7	Bottom Ash (Bed Drain)	0.005	N/A		871	101.4	1360	3
8	Dirty Flue Gas	0.311 (5)	0.936		858	101.0	0.326	304
9	Clean Flue Gas	0.304	0.371		177	109.9	0.819	61
10	Cool Water (Combustor)	3.109		187	29	(9)	996	382
11	Hot Water	3.109		190	66	(9)	980	853
12	Cool Water (Fluegas Cooler)	1.645		99	29	(9)	996	202
13	Hot Water	1.645		101	66	(9)	980	452
14	Cool Water (Bed Drain Cooler)	0.026		2	29	(9)	996	3
15	Hot Water	0.026		2	66	(9)	980	7
16	Hot Water (Heat Exchanger)	4.780		293	66	(9)	980	1312
17	Cool Water	4.780		288	29	(9)	996	587
18	Flyash (Fluegas Cooler)	(Assume 0)						
19	Flyash (Baghouse) (6)							

NOTES:

1) At 7.0 m/s superficial gas velocity and 25% excess air in combustor.

2) Based on tar sands fluid coke.

3) Approximate or typical values

4) Radiation heat losses for combustor, cyclone, and ducting total 17 kW.

5) Stream 6 contains 0.007 kg/s of particulate matter equivalent to 7 kW in sensible heat content.

6) Stream 19 cannot be accurately calculated at this stage.

7) At actual temperature and pressure.

8) Based on design Ca:S ratio of 2.3

9) Pressure for water streams cannot be accurately calculated at this stage.

TABLE 3.3 - MATERIAL AND ENERGY BALANCE - MINIMUM CALORIFIC VALUE FUEL

STREAM	DESCRIPTION	MASS FLOW (kg/s) (1)	VOLUMETRIC FLOW		TEMPERATURE (°C)	PRESSURE (kPa - abs.)	DENSITY (kg/m^3) (7)	HEAT CONTENT (kW) (4)
			(Am^3/s)	(l/min) (7)				
1	Fuel (2)	0.083	N/A		21	101.4	960	569
2	Limestone	0	-		-	-	-	-
3	Total FD Air	0.233	0.133		57	170.4	1.75	13.5
4	Secondary FD Air	0.116	0.093		57	122.1	1.25	6.7
5	Primary FD Air	0.105	0.080		57	127.5	1.31	6.0
6	Loop Seal Air	0.012	0.008		57	153.2	1.57	0.7
7	Bottom Ash (Bed Drain)	0.027	N/A		871	101.4	1360	25.3
8	Dirty Flue Gas	0.289	0.893		360	101.0	0.305	300
9	Clean Flue Gas	0.271	0.331		177	109.9	0.819	55
10	Cool Water (Combustor)	1.504		91	29	(8)	996	185
11	Hot Water	1.504		92	66	(8)	980	413
12	Cool Water (Fluegas Cooler)	1.490		90	29	(8)	996	183
13	Hot Water	1.490		91	66	(8)	980	409
14	Cool Water (Bed Drain Cooler)	0.141		9	29	(8)	996	17
15	Hot Water	0.141		9	66	(8)	980	39
16	Hot Water (Heat Exchanger)	3.135		192	66	(8)	980	861
17	Cool Water	3.135		189	29	(8)	996	385
18	Flyash (Fluegas Cooler)	(Assume 0)						
19	Flyash (Baghouse) (6)							

NOTES:

1) At 7.0 m/s superficial gas velocity and 25% excess air in combustor.

2) Based on coal washery rejects.

3) Approximate or typical values

4) Radiation heat losses for combustor, cyclone, and ducting total 17 kW.

5) Stream 6 contains 0.018 kg/s of particulate matter equivalent to 17 kW in sensible heat content.

6) Stream 19 cannot be accurately calculated at this stage.

7) At actual temperature and pressure.

8) Pressure for water streams cannot be accurately calculated at this stage.

0243-0034

TABLE 3.4 - MATERIAL PROPERTIES

1. COAL AND FLUID COKE

	Fluid Coke	Coal Rejects
Total moisture (%)	3.6	20.1
Surface moisture (%)	-	7
Bulk density (kg/m^3)	800	960
Size distribution:		

Size	Wt. %	Wt. %
19 mm - 3 mm	-	3.04
13 mm - 6 mm	-	20.20
6 mm - 3 mm	-	28.34
3 mm - 16 mesh	-	16.90
16 mesh - 28 mesh	-	9.52
28 mesh - 100 mesh	-	22.00
100 meash - 0	100	-

2. WOOD CHIPS

Moisture (%)	30-60
Bulk density (kg/m^3)	160

Size distribution:

Screen Size (mm)	% Retained
50	0
30	10.64
25	15.97
15	34.74
10	30.71
5	5.88
Fines	2.06
Bark	9.45

3. LIMESTONE

Moisture (%)	Dry
Bulk density (kg/m^3)	1,600

Size distribution:

Size (mm)	Weight %
minus 6	100
6.00-4.75	9.78
4.75-3.35	14.50
3.35-2.36	17.20
2.36-1.70	11.40
1.70-1.18	9.10
1.18-0.85	6.80
0.85-0.25	13.23
minus 0.25	17.90

TABLE 3.5 - COOLING WATER REQUIREMENTS

COOLING LOAD	NORMAL FLOW		DESIGN FLOW	
	(kg/s)	(l/min)	(kg/s)	(l/min)
Bayonet Tubes	3.121	189	3.612	218
Flue Gas Cooler	1.645	99	2.589	156
Bed Drain Cooler	0.227	14	0.340	20
No. 2 Transfer Conveyor	0	0	0.377	23
Heat Exchanger	5.013	302	6.918	417

NOTES:

1. These flows are based on mass and energy balance calculations and not on specific vendor figures, so are subject to change.
2. Flows are based on a water inlet temperature (outlet from heat exchanger) of 29°C and an outlet temperature of 66°C.
3. Design flow figures account for maximum combustor temperature and flows.

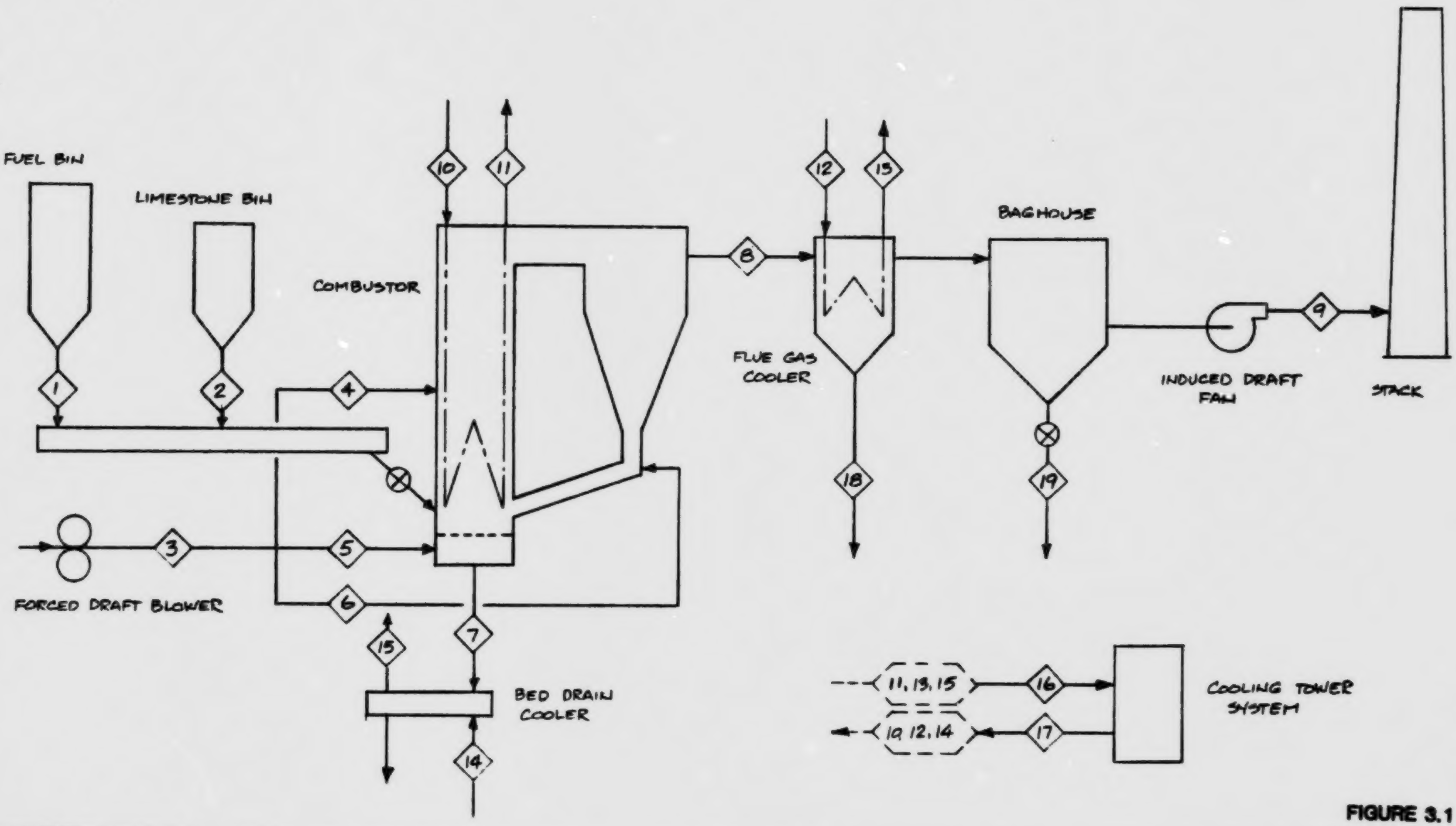
FUEL BIN
LIMESTONE BIN
COMBUSTOR
FORCED DRAFT BLOWER
BED DRAIN COOLER
FLUE GAS COOLER
BAGHOUSE
INDUCED DRAFT FAN
STACK
COOLING TOWER SYSTEM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
11, 13, 15
10, 12, 14

FIGURE 3.1

Design	Drawn	Check	Appd	Issued for	Date	Rev

integ
Intercontinental Engineering Ltd

PROCESS FLOW SCHEMATIC

B

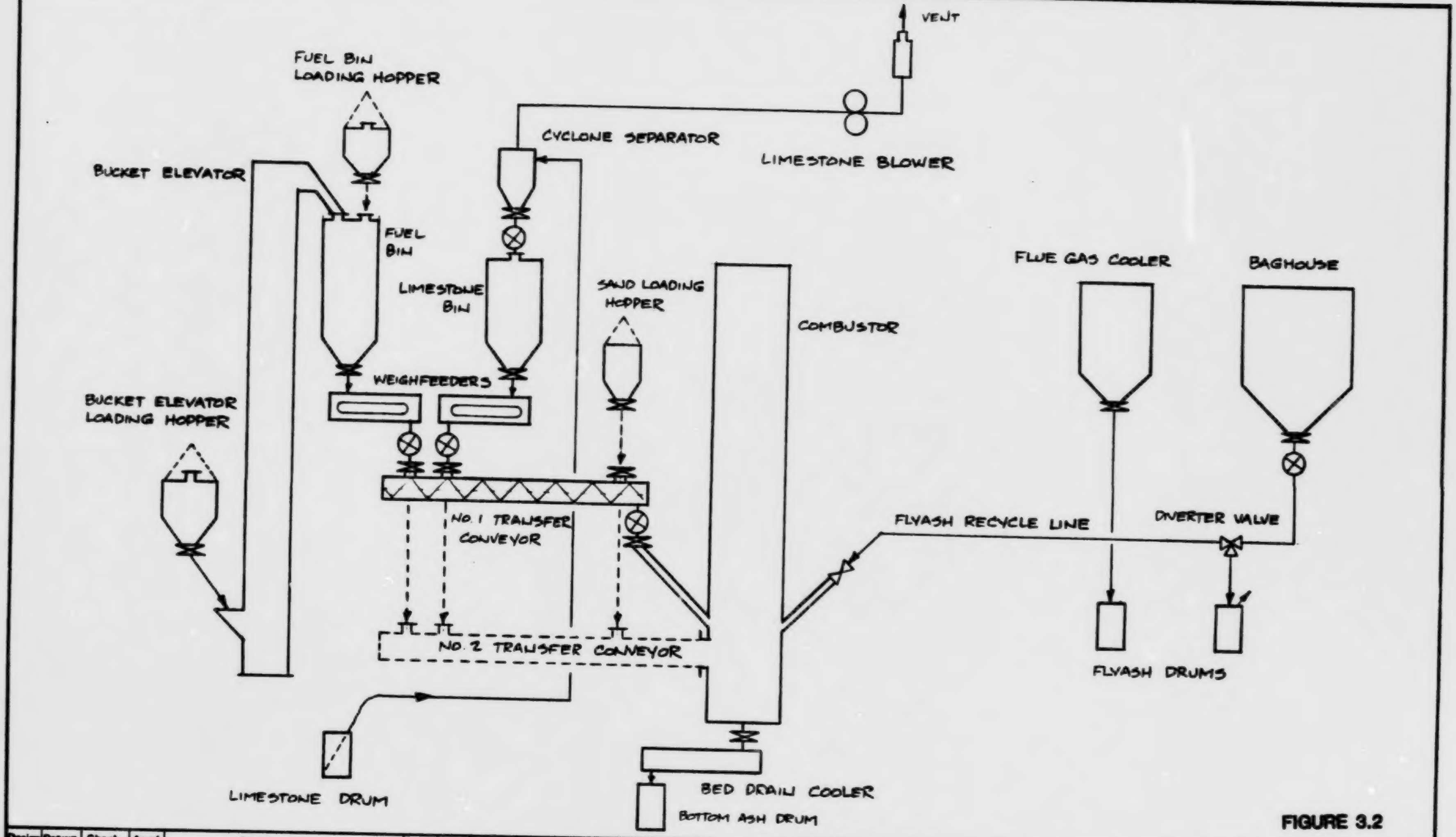
VENT
FUEL BIN LOADING HOPPER
CYCLONE SEPARATOR
LIMESTONE BLOWER
BUCKET ELEVATOR
FUEL BIN
LIMESTONE BIN
SAND LOADING HOPPER
COMBUSTOR
FLUE GAS COOLER
BAGHOUSE
WEIGHFEEDERS
BUCKET ELEVATOR LOADING HOPPER
NO. 1 TRANSFER CONVEYOR
FLYASH RECYCLE LINE
DIVERTER VALVE
NO. 2 TRANSFER CONVEYOR
FLYASH DRUMS
LIMESTONE DRUM
BED DRAIN COOLER
BOTTOM ASH DRUM

FIGURE 3.2

Design	Drawn	Check	Appd	Issued for	Date	Rev

integ
Intercontinental Engineering Ltd

MATERIALS HANDLING SCHEMATIC

B

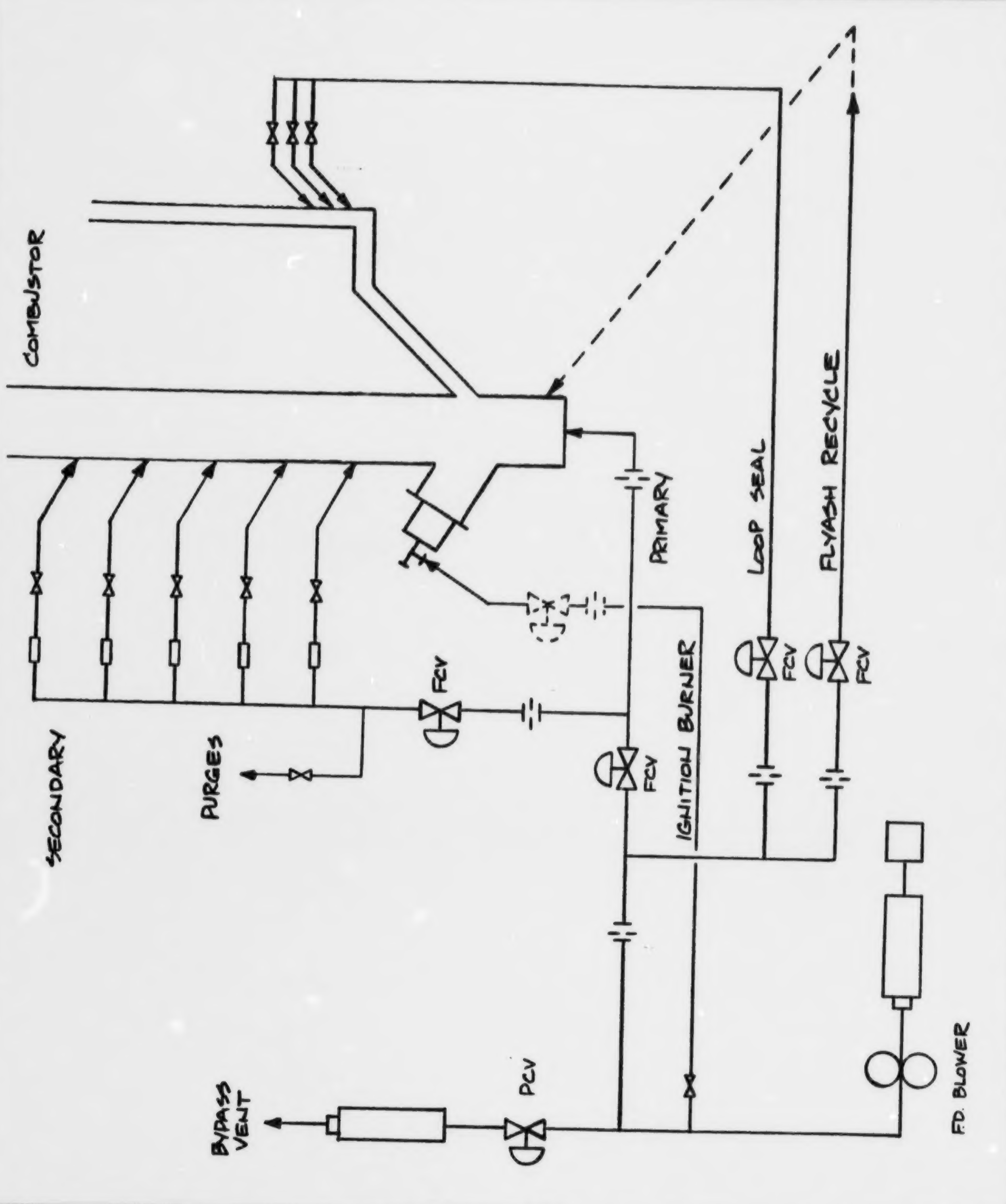
COMBUSTOR
SECONDARY
PURGES
FCV
PRIMARY
IGNITION BURNER
FCV
LOOP SEAL
FCV
FLYASH RECYCLE
FCV
BYPASS VENT
PCV
F.D. BLOWER

FIGURE 3.3

integ
Intercontinental Engineering Ltd.

SCALE		DATE
DRAWN		
CHECK		
APP'D.		

AIR SYSTEM SCHEMATIC

A

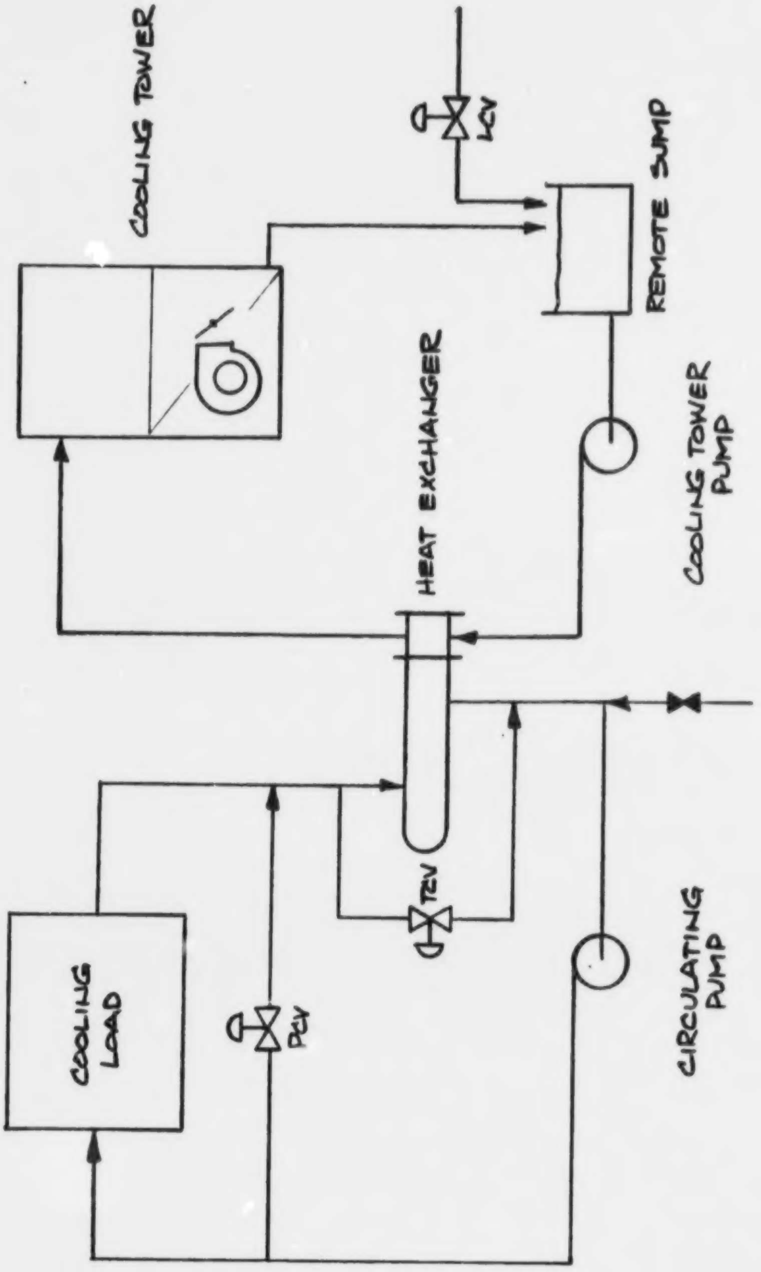
COOLING TOWER
LCV
REMOTE SUMP
HEAT EXCHANGER
COOLING TOWER PUMP
TCV
CIRCULATING PUMP
COOLING LOAD
PCV

FIGURE 3.4

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SCALE		DATE	
DRAWN			
CHECK			
APP'D.			

COOLING SYSTEM SCHEMATIC

A

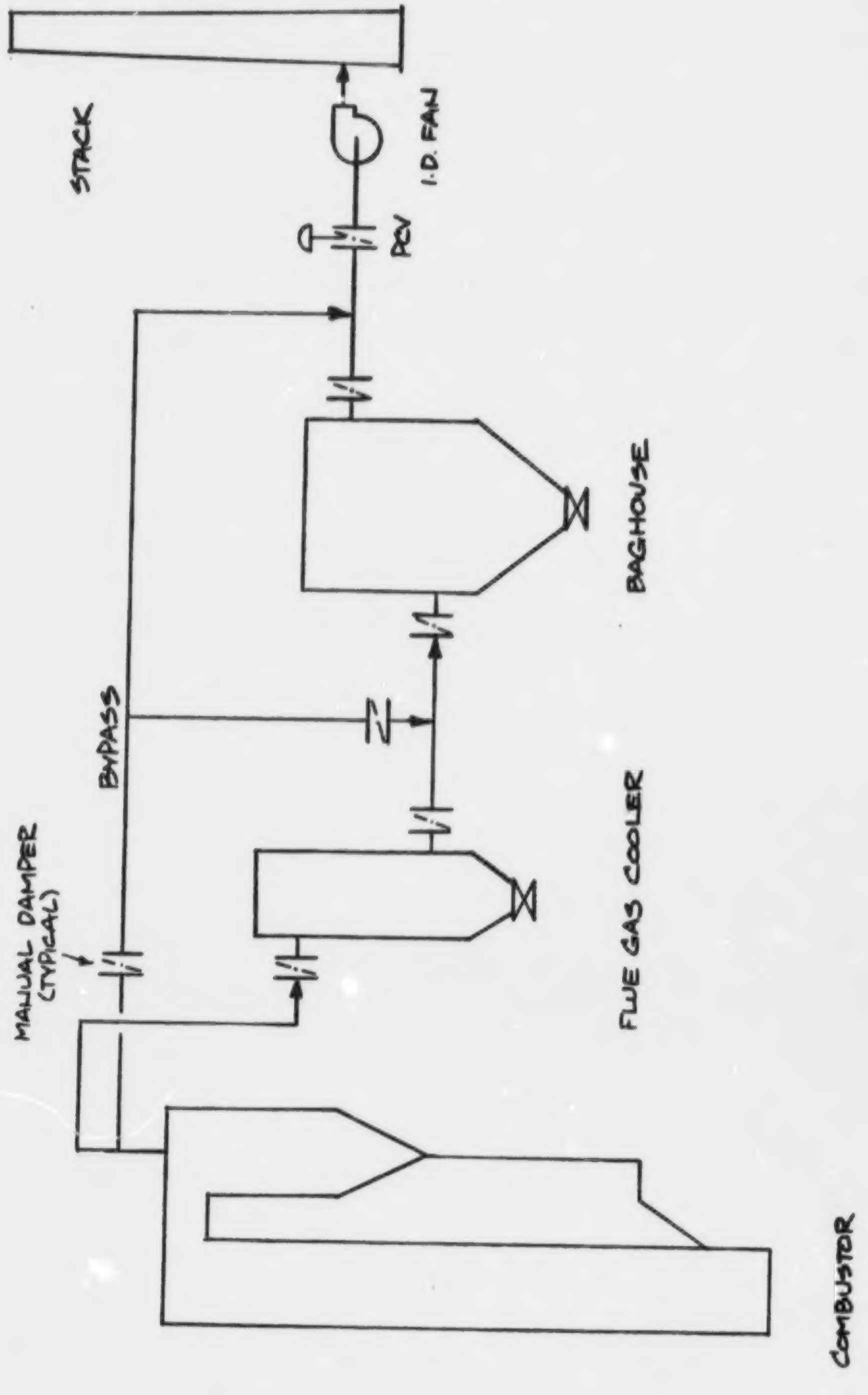
STACK
I.D. FAN
PCV
BYPASS
BAGHOUSE
MANUAL DAMPER
(TYPICAL)
FLUE GAS COOLER
COMBUSTOR

FIGURE 3.5

SCALE		DATE
DRAWN		
CHECK		
APP'D.		

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FLUE GAS SYSTEM SCHEMATIC

A

SECTION 4.0

EQUIPMENT DESCRIPTIONS

4.0 DESIGN DESCRIPTION

This section provides more specific system and component descriptions than were given in the previous section. The description is basically broken down into mechanical components (sections 4.1 to 4.11), electrical equipment (section 4.12), instrumentation and control equipment (section 4.13) and building and structure (section 4.14). Descriptions of mechanical components, identified by specification numbers, were taken from the Equipment Specifications included in Appendix V, contained in Volume II of this report. Various electrical, I&C and Civil/Structural specifications are included in the drawings, which are contained in Appendix VII in Volume IV. A full list of drawings is given in Section 6.0.

A preliminary vendor proposal solicitation was performed, based on the technical equipment specifications. Proposals received are included in Appendix VII, contained in Volume III. A comparitive evaluation of the proposals was made in order to select the pricing basis for the capital cost estimate. Proposal selection is based on technical compliance, then lowest cost, and is for cost estimating purposes only. The proposal comparison sheets are included in Appendix IV of this volume.

The mechanical descriptions include thumbnail descriptions of each component, performance summary and identification of the selected proposal. Selection criteria are given where relevant. Further information for each component can be obtained from the specifications and equipment proposals.

4.1 Combustor

111-1 Atmospheric Recirculating Fluidized Bed Combustor

Description: Refractory lined carbon steel pipe with nominal 1,016 mm outside diameter, 406 mm inside diameter and 6,700 mm height. A 660 mm inside diameter refractory lined cyclone and refractory lined recycle loop are included.

Performance:	Thermal rating (input)	-	724 kW
	Operating temperature (max.)	-	1,100°C
	Operating pressure (max.)	-	69 kPa (g)
	Fluidizing velocity range	-	1.4 - 7 m/s

Selection: GA Technologies

4.2 Air System

121-1 Forced Draft Blower

Description: Positive displacement rotary combustion air blower. The unit is complete with intake and discharge silencers and a removable acoustic enclosure for noise abatement. Variable speed drive was specified as an optional extra, but is not included in the design.

Performance:
Discharge volume - 0.378 Sm^3/s
Discharge pressure - 83 kPa (g)
Drive - 55 kW

Selection: Aerzen Model GMa 13F7 rotary lobe blower

4.3 Ignition Burner

131-1 Ignition Burner

Description: Gas burner suitable for propane firing, complete with flame scanner and air and gas valve train and prewired local control panel. The burner must be capable of firing against a combustion chamber backpressure.

Performance:
Thermal output - 470 kW
Fuel pressure - 103 kPa (g)
Air pressure - 70 kPa (g)
Backpressure (norm.) - 14 kPa (g)
Backpressure (max.) - 35 kPa (g)

Selection: Pyronics NM 1001
Final selection must consider the required burner penetration size, as this must be minimized. The referenced selection is 200 mm in diameter, but will only fire against 28 kPa(g) backpressure.

4.4 Ash Handling

141-1 Bed Drain Cooler

Description: Water cooled, hollow shaft, hollow flight screw feeder complete with variable speed drive. The cooler will be inclined upwards at 15°.

Performance:
Thermal rating - 49 kW
Ash temperature, inlet - 1,100°C

Ash temperature, discharge - 150°C
Normal ash feed rate - 0 to 0.027 kg/s
Drive - 0.37 kW

Selection: Denver Equipment Model No. S710-4
Holo-Flite Processor
Final selection must consider overall height of the unit, as this must be minimized. The referenced cooler is 300 mm long between inlet and discharge flanges.

4.5 Cooling System

151-1 Bayonet Tube Heat Exchanger

Description: Four tubes, 7,160 mm long, consisting of a 30 mm sch. 40 outer tube and a 16 mm (5/8 in) 18 BWG inner tube. The tubes are T304 stainless steel and are both provided with hose connections.

Performance:
Thermal rating - 546 kW
Water temperature, inlet - 29°C
Water temperature, outlet - 66°C
Water flow - 3.612 kg/s

Selection: GA Technologies

152-1 Flue Gas Cooler

Description: Shell and tube flue gas to water heat exchanger. The cooler is to be oriented vertically, equipped with sloped baffles and shall include a particulate removal connection. The tube bundle must be removable and provision is to be made for isolation of 30 to 50 percent of the heat exchange surface.

Performance:
Thermal rating - 391 kW
Water temperature, inlet - 29°C
Water temperature, outlet - 66°C
Water flow - 2.589 kg/s

Selection: Mueller Template plate and shell heat exchanger. The referenced selection consists of a bank of 7 plate heat exchangers contained in a rectangular shell, and provides for isolation of 3 exchangers (43% of total surface) from the water circuit.

153-1 Water Cooling System

Description: Closed circuit water cooling system consisting of an evaporative cooling tower and a shell and tube heat exchanger. The cooling tower is to be equipped with an external sump (not included) and modulating fan capacity control dampers. The heat exchanger is in closed circuit with the cooling system loop.

Performance: (Heat exchanger only)

Thermal rating - 1,093 kW
Water temperature, inlet - 66°C
Water temperature, discharge - 29°C
Water flow - 7.232 kg/s

Selection: Baltimore Aircoil Model HK8-14-3-1A heat exchanger and Model VXT-185 cooling tower. The cooling tower is equipped with a 22 kW fan motor and has a 12.866 kg/s spray water system.

153-2 Cooling Water Pumps

Description: Two centrifugal pumps for the following services: circulating water and cooling tower spray system.

Performance:	Circulating	Cooling Tower
Flow	450 l/m	1,210 l/m
Head	63 m	18 m
Drive	11 kW	7.5 kW

Selection:	Circulating	Cooling Tower
Company	Canada Pumps	
Model	3 x 1½ x 9 CRO	4 x 3 x 11 CRO
Pump RPM	3500	1750

Pump performances are based on the specification of the assumed cooling water system selection. Performance may differ if an alternate selection or specification change is made.

153-3 Cooling Tower Sump

Description:	Closed, cylindrical tank with various nozzle connections.	
Performance:	Diameter	- 1,830 mm
	Height	- 1,780 mm
Selection:	W.A. Thom (Fabricator)	

4.6 Air Quality Control

161-1 Baghouse

Description:	Negative pressure fabric filter dust collector with automatic pulse jet bag cleaning system and single dust collection hopper. Gross air to cloth ratio not to be greater than 3.5:1.	
Performance:	Gas volume	- 0.59 Am^3/s
	Gas temperature, normal	- 177°C
	Gas temperature, design	- 260°C
	Dust loading	- 48-79 g/Am^3
	Moisture	- 4-26 mole percent
Selection:	Joy Pulseflo PF^{2}6004-56 The baghouse structure and the filter bags must be capable of withstanding the peak operating temperature of 260°C for a period of one hour. This was the only proposal to comply.	

161-2 Flyash Recycle Rotary Valve

Description:	100 mm diameter rotary airlock valve with variable speed drive and pipeline adaptor. Venting may be required as pipeline pressure must not be allowed to reach the baghouse hopper.	
Performance:	Ash flow rate	- 0-82 kg/h
	Ash bulk density	- 565-642 kg/m^3
	Differential pressure	- 62 kPa
	Drive	- 0.37 kW
Selection:	Ducon-Mikropul 100 mm PERMA/flo Type B rotary valve with an additional wye fitting for venting blowback pressure. Here also, total equipment length is important and will affect the final selection, however it is equally important that the valve seal the baghouse against pneumatic conveying line pressure.	

4.7 Flue Gas Handling

171-1 Induced Draft Fan

Description: Centrifugal pressure blower with drive on common baseplate and acoustic protection.

Performance:

Discharge volume	-	0.586 Am^3/s
Discharge pressure	-	8.7 kPa(g)
Inlet temperature (norm.)	-	177°C
Inlet temperature (max.)	-	260°C
Density (at 177°C)	-	0.809 kg/Am^3
Drive	-	19 kW

Selection: Joy 275-10 design 5B pressure blower. This proposal included inlet and discharge silencers, which may not now be required if the fan is to be located in the garage area.

172-1 Stack

Description: Double shell insulated steel stack with supporting guy wires and reduced outlet opening.

Performance:

Mass flow	-	0.474 kg/s
Volume flow	-	0.586 Am^3/s
Temperature	-	177°C
Stack height	-	12.5 m

Outlet velocity should be 15 m/s during normal expected volume flow of 0.376 Am^3/s.

Selection: Diamond Luftek Construction
The only proposal received provided a 305 mm inside diameter stack.

4.8 Fuel System

211-1 Fuel Storage and Metering System

Description: Includes fuel storage bin, vibratory bin discharger, belt type gravimetric weighfeeder, diverter-sampling valve, manual slide gates at discharger and sampling valve and rotary valve. All components will be assembled on one compact frame.

Performance:

Bin capacity	-	1,800 kg (at 960 kg/m^3)
Mass flow	-	0.095 kg/s

Turndown ratio - 20:1
Fuels - coke, coal, peat, wood chips

The rotary airlock must isolate the weighfeeder from combustor backpressure.

Selection: Merrick Canada Ltd., with the following components:

- 20 inch Merrick Model 950 DSC-1 weighfeeder
- 48 inch Vibranetics Model BD-4 bin discharger with 1.5 kW drive
- 3.1 m^3 mild steel bin
- 200 mm square Kice Model VB8x8 rotary airlock with 0.75 kW drive.

212-1 Bucket Elevator

Description: Centrifugal belt type bucket elevator in dust-tight casing. Maximum allowable height is 9,340 mm.

Performance: (Based on coal rejects fuel)
Mass flow - 1 kg/s
Density - 960 kg/m^3

Selection: Stephens Adamson Model SB 064-A with 0.75 kW drive. The height of the discharge opening must be as high as possible within the 9,340 mm overall height. This must be considered during final selection.

4.9 Sorbent System

221-1 Sorbent Storage and Metering System

Description: Includes limestone storage bin, bin discharger, belt type gravimetric weighfeeder, diverter-sampling valve, manual slide gates at discharger and sampling valve and rotary valve. All assembled on a common frame.

Performance: Bin capacity - 800 kg (at 1,600 kg/m^3)
Mass flow - 0.014 kg/s
Turndown ratio - 20:1

Selection: Merrick Canada Ltd., with the following components:

- 12 inch Merrick Model 951 DSC-1 belt weigher with constant speed drive.
- Model MCF1900-B screw prefeeder with 0.37 kW variable speed DC drive.
- 24 inch Vibranetics Model BD-2 bin discharger with 0.75 kW drive.
- 1 m^3 mild steel bin.
- 150 mm square Kice Model VB6 x 8 rotary airlock with 0.75 kW drive.

Merrick proposed a different sorbent system than for coal. The actual metering is done by the screw prefeeder as instructed by the weighbelt. The prefeeder will also prevent possible flooding of the weighbelt by the fine material.

222-1 Pneumatic Conveying System

Description: Vacuum type pneumatic conveying system including positive displacement blower, cyclone collector with rotary airlock, suction lance and length of flexible hose.

Performance:

Mass flow	-	0.2 kg/s
Material density	-	1,600 kg/m^3
Material size	-	Minus 6 mm

Selection: Ducon-Mikropul - including:

- Robus Model RVT-60 rotary blower with 5.6 kW drive.
- Ducon-Mikropul Model CR-24 cyclone.
- Ducon-Mikropul 6 inch Perma/flo type B rotary airlock with 0.37 kW drive.

Compactness is a selection criterion, as the cyclone and rotary valve are installed above the limestone bin and could interfere with the overhead crane.

4.10 Portable Loading Hoppers

231-1 Portable Hoppers

Description: Three fabricated storage hoppers complete with wheels, lifting attachments and manual slide gates at discharge openings. Hoppers are for bucket elevator, fuel bin and sand loading.

Performance: (Capacity based on material handled)

- Bucket elevator loading hopper - 0.73 m^3 or 700 kg (coal at 960 kg/m^3)
- Fuel bin loading hopper - 0.46 m^3 or 440 kg (coal at 960 kg/m^3)
- Sand loading hopper - 0.16 m^3 or 260 kg (sand at 1600 kg/m^3).

Selection: Burrard Yarrows (Steel Fabricator)

4.11 Combustor Feed

241-1 Fuel Transfer Screw No. 1

Description: Trough type helical screw conveyor with variable speed drive. Three inlets and one discharge opening are provided.

Performance: (Based on coal rejects at 960 kg/m^3)

Mass flow, design - 0.095 kg/s
Mass flow, minimum - 0.008 kg/s

Selection: FMC/Link-Belt 150 mm diameter horizontal screw conveyor, 2,590 mm long, to operate at 27 RPM at design feedrate. The referenced proposal did not include a variable speed drive (a 37 kW drive was estimated separtely) and included a drive seal with 93°C temperature limitation. The drive must be provided and the seal must be upgraded.

241-2 Rotary Airlock Valve

Description: 100 mm diameter drop-through rotary airlock with variable speed drive.

Performance: (Flows are based on coal rejects at 960 kg/m^3)

Mass flow, design	-	0.095 kg/s
Mass flow, minimum	-	0.008 kg/s
Differential pressure	-	35 kPa(g)
Temperature, normal	-	200-400°C
Temperature, maximum	-	800°C

Selection: Ducon-Mikropul 100 mm diameter PERMA/flo type B rotary airlock with 0.56 kW variable speed drive. This proposal was selected because it had the highest temperature limitation.

242-1 Fuel Transfer Screw No. 2

Description: Tube type helical screw conveyor with variable speed drive. Two flanged inlet openings and an open ended discharge as well as water jacketed discharge section are provided. The screw changes from full to half pitch for the discharge third of its length and is fabricated in T310 stainless steel in that section.

Performance: (Flows are based on coal rejects at 960 kg/m^3)

Mass flow, design	-	0.095 kg/s
Mass flow, minimum	-	0.008 kg/s
Temperature at discharge	-	1,100°C
Backpressure, design	-	52 kPa(g)
Backpressure, normal	-	21 kPa(g)
Thermal rating	-	57 kW

Selection: Christian Engineering Model XN6 VP Feeder with 150 mm screw diameter and 0.75 kW variable speed drive. The proposal included the variable pitch screw, carbon steel/stainless steel flights and water jacket, but no design detail on the jacket was provided. It was felt this was the only proposal that addressed the criteria of minimum penetration size and performance reliability (warranty). The outside diamter of the jacketed section (230 mm), the smallest of those proposed, is also a selection criterion.

4.12 Electrical Equipment

Motor Control Center

The principal item of electrical equipment will be a 575 Volt motor control center. This will contain the starters for all of the 575 volt AC motors. The motor control center will supply power to a 600 to 120/240 Volt transformer and 120/240 Volt panelboard, mounted separately, which will distribute power to all of the variable speed DC motors. Also, by means of a similarly rated transformer and panelboard mounted in the motor control center, it will distribute power to all instrumentation and AC motor starter control circuits.

The AC motor starters will be plug-in units, removable for repair or replacement, and to permit modification of the motor control center if it is found necessary in the future to change the quantity and/or rating of ac motors supplied. The AC motor starters and feeder units will all be equipped with moulded case ciruit breakers rather than fused disconnect switches for increased safety to the research staff who may otherwise be tempted to replace any blown fuses. The short circuit or fault level at the motor control center must be determined so as to establish the bus bracing required and minimum circuit breaker interrupting rating that is acceptable.

DC Drives

In order to utilize the advantages of standardization, the DC drives, with the execption of those of the weighfeeders, have been assumed to be the products of a single manufacturer. The DC drive controllers are relatively complex static devices, so that trouble shooting will be facilitated if an effort is made to ensure that they are all as similar as possible. Partly for this reason, where feasible, they are supplied at 230 Volts AC, rather than some at 115 and some at 230 Volts. In order to provide protection to the controllers and facilitate their field installation, they are grouped inside an overall dc drive controller cabinet.

The weighfeeder drives are an exception to the above because these drives are usually integrated with the weighfeeders by the weighfeeder manufacturer. The precise electrical requirements of the weighfeeder drives will be dependent on the weighfeeders selected.

This equipment is specified in detail on the electrical drawings, so no written specification has been prepared. No location for the electrical panels has been identified, although it is assumed they will be installed near the control room, which EMR proposes to install on the new platform to be built at elevation 4,700 in the garage area.

Motors

The motors will be totally enclosed or explosion proof. Explosion proof motors are specified for the fuel system, from bucket elevator to transfer conveyor. This requirement may be reconsidered during final design, depending upon dust tightness of vendor equipment.

The preliminary motor list in Table 4.1 provides a complete listing of motors with data on size and voltage.

4.13 Instrumentation and Control Equipment

Control Panel

A free standing panel with vertical front face has been specified. Design is in accordance with a location in the controlled environment of a plant control room. Space only has been allocated for a data logger (dimensions according to Kaye Instruments digi-strip III). A spare cutout with fillerplate will be provided to allow for a later addition of another controller, should the need arise to expand the analog controls. The panel will include an annunciator, recorders, indicators, controllers, weighfeeder remote control stations (insert panels), variable speed drive remote control stations (insert panels), and push button and indicating light stations for remote operation of AC drives.

Annunciator

A 43 point annunciator has been specified and will be located in the upper part of the panel front. Six spare points will be provided plus an additional 6 spare points reserved for flue gas analyzer alarms.

Recorders

Two 3-pen recorders have been specified to record combustion air flows and fuel and sorbent flows. Recording of other parameters will be left to the data logger. The recorders will be of compact (narrow case) design with 2 hours of record visible from the front and a further 10 hours visible with the instrument partially withdrawn from its shelf. Each recorder will include (a pen independent) indicator for each input. The recorder shelf will have 3 empty slots (with filler plates) for the future addition of flue gas anlysis recorders.

Indicators

Nine 2 point indicators have been specified plus a mounting shelf with one spare slot (with filler plate) for a future addition, if required. Process parameters such as combustor pressure and average temperature, flue gas pressures and temperatures and cooling water temperatures will be indicated. Other process parameters not as critical to the operation of the plant will be accessible either at the data logger and/or the shared controllers.

Controllers

Shared controllers (micro-processor based analog controllers) have been specified with Westinghouse selected as directed. Three controllers with virtually all I/O parts assigned have been specified. The controllers will include an integral shared display (LED type) adequate for accessing all process parameters and implementing all control actions. The controllers have the capability of being interfaced to a communications control console (CRT display station).

Control Valves

Control valves on water service and small air lines have been specified as globe valves. Larger air valves have been specified as butterfly valves. All actuators will be of the (spring return) diaphragm type, and will therefore move to a predictable position (open or closed) on signal or air supply failure.

- cooling water valves fail open to protect bayonet tubes and flue gas cooler from loss of coolant.
- cooling water supply pressure and temperature control valves fail to a closed position to maintain cooling water pressure and low coolant temperature.
- sump level valve fails closed to prevent flooding.
- fly ash recycle valve fails closed.
- combustion air pressure control valve (bypass vent) fails closed to preserve combustion air pressure.
- combustor pressure control valve (I.D. inlet) fails open to avoid interrupting draft.
- primary, secondary and loop seal air valves fail open to prevent loss of combustion and sealing air.

Control valves not receiving pneumatic control signals from local loops are specified with a (separately mounted) current to pressure transducer. Electronic control signals will be 4-20 mADC.

Flow Elements

Distribution of secondary air flows will be measured by rotameters and controlled by close coupled manual ball valves.

Orifice plates have been specified for all major air flow measurements. Services on small lines will be supplied with complete metering tubes to avoid installation alignment problems. Total air flow measurement will require the use of a straightening vane to provide an accurate signal with the available upstream straight piping length.

Major water flow measurements will be accomplished by Vortex shedding meters as directed. (Transmitter signals will be 4-20 mADC).

Purgemeters

Combustor and dirty flue gas passage pressure tapping points being used with pressure switches and/or transmitters will be supplied with a purgemeter (constant differential regulator plus rotameter) to provide a constant purge of the tapping using instrument air.

Local Controllers

The cooling water supply system is specified with local pressure, temperature and level control only because these loops require little operator intervention. Output control signals will be 20-100 kPa.

Other Field Instruments

Type K thermo-couples have been standardized on as directed. Temperature and pressure transmitter, will be of the two wire type with a 4-20 mADC output signal. Transmitters are specified for pipestand mounting. Local temperature gauges will be of the bimetallic type. Other instruments will include pressure gauges, a level gauge, pressure switches, a temperature switch, flow switches of the paddle type and level switches of the float operated type.

4.14 Building and Structure

Civil

The civil work will include: investigation of soil conditions in certain areas to confirm to existing records, location of existing underground services, demolition of existing grade slab to allow for new foundations, construction of the new foundations and pedestals, backfilling and making good to existing slabs. There will also be new penetrations through existing walls for new pipework.

Efforts have been made to reduce the amount of expensive, disruptive work involved in constructing foundations. This has entailed designing foundations of small plan area to bear directly on the bedrock instead of shallower, larger foundations on the existing fill below the existing slab. Where possible, foundations have been made in plain concrete to save time of construction.

Structural

The structural work will include: provision of a support structure for the combustor, cyclone and auxiliary equipment, a new "penthouse" structure on the existing roof, and a support structure for the new cooling tower. All structures will be of structural steel rolled sections with steel grating platforms.

Access will be by a steel staircase serving platforms up to el. 7,770 and then by fixed metal ladders to the new "penthouse" platforms at el. 10,973 and 14,400.

The main structural rigid framework uses bracing for stability only where it is unobstrusive and does not impede access or circulation. A special case in point is the rigid frame on the central column line where it is required that there be removable members for access to the combustor. Removal of these members and those denoted as such on the platform plans will create a corrider through to the combustor and cyclone which will enable them to be easily moved out of the structure if the need arises.

There are certain areas where modifications to existing platforms will be required at adjoining new platforms. The platforms in question are at el. 4,700 where there is a conflict with an existing stair landing and at el. 7,770 where there is interference with an existing platform at el. 7,620.

Where new equipment or construction imposes additional loading on existing structural members or walls an analysis shall be done in the final engineering phase to determine whether strengthening of existing work is required. This type of analysis is not within the present scope of work and does not form part of this report.

The safety features required in the new structural work will include steel handrails with kickplates at edges of platforms or major openings and kickplates around equipment openings.

The structural members will arrive on site suitably primed. The final painting of the structural members, grating etc., will be decided during construction.

Architectural

In general it has been considered that the new additions to the building will be clad in insulated vinyl covered steel siding. This type of cladding is considerably cheaper than new concrete walls which match the existing building. It also has the advantage of light weight, which in the case of the new penthouse on the roof will reduce the amount of strengthening required to existing roof beams.

The colour selected for the vinyl covered siding should be matched as closely as possible to the neutral greys of the existing concrete.

The new penthouse roof will be a built-up tar and gravel type to match the existing.

New mandoors and frames will be galvanized, insulated steel industrial quality doors, painted after installation.

TABLE 4.1 - PRELIMINARY MOTOR LIST

MOTOR NO.	DESCRIPTION	SIZE (kW)	VOLTAGE	REMARKS
M1	Forced draft blower	45	575V AC	
M2	Bed drain cooler	0.75	180V DC	Variable Speed
M3	Baghouse rotary valve	0.38	180V DC	Variable Speed
M4	Induced draft blower	11.25	575V AC	
M5	Fuel bin discharger	2.26	575V AC	Explosion Proof
M6	Fuel weighfeeder	0.19	125V DC	Variable Speed Explosion Proof
M7	Bucket elevator	0.75	575V AC	Explosion Proof
M8	Limestone bin screw prefeeder	0.38	180V DC	Variable Speed
M9	Limestone bin weighfeeder	0.19	125V DC	Variable Speed
M10	Limestone blower	3.75	575V AC	
M11	No. 1 transfer conveyor	0.75	180V DC	Variable Speed Explosion Proof
M12	No. 2 transfer conveyor	1.13	180V DC	Variable Speed Explosion Proof
M13	Feed chute rotary valve	0.38	90V DC	Variable Speed Explosion Proof
M14	Circulating water pump	11.25	575V AC	
M15	Cooling tower pump	7.5	575V AC	
M16	Cooling tower fan	22.5	575V AC	
M17	Limestone separator rotary valve	0.38	575V AC	
M18	Fuel weighfeeder rotary valve	0.75	575V AC	
M19	Limestone weighfeeder rotary valve	0.75	575V AC	

SECTION 5.0

PRELIMINARY OPERATING PROCEDURE

5.0 PRELIMINARY OPERATING PROCEDURE

5.1 Scope

These procedures describe the operating philosophy of the ARFBC pilot plant. The operating procedures are based on burning a variety of fuels from high sulphur fluid coke, high sulphur coal, high ash coal rejects, to biomass fuels. This wide range of fuel characteristics necessitates generalization of the operating procedures. The procedures are not intended to describe operation of a specific type of fuel. Instead, the operating procedures reflect a high degree of flexibility to allow for a wide range of test conditions.

The procedures are preliminary, and instrumentation specifics, as well as most process set points, are not included pending final design and equipment selection. Process parameters may be noted **TBV** (to be verified) or **TBD** (to be determined in the next phase of the project). Further operating instructions will be prepared at the time of combustor delivery.

The procedure incudes operation of the feed system and auxiliary equipment connected to the ARFBC. Start-up, steady-state operation and shut-down procedures are described in the following sections.

5.2 Fill Fuel and Sorbent Bins

Fuel Bin

There are several alternatives for loading fuel into the fuel storage bin in order to provide maximum operating flexibility. These will be described as they occur in the procedure.

a) Fill the bucket elevator loading hopper. Two methods are provided:

   1) Wheel the hopper to the fuel receiving area, fill and wheel back to the bucket elevator.

   2) (Applicable when existing coal bunkers have been charged with fuel.) Wheel the hopper beneath the discharge gate of the bunker in use. Connect the flexible connection to the gate, clamp tight, open hopper vent, then open gate and fill the hopper. Close the gate, disconnect and wheel the hopper to the bucket elevator.

b) Discharge hopper contents into the bucket elevator.
Rig and hoist the hopper to the first platform. Connect the flexible connection to the hopper outlet, clamp tight and open the hopper discharge gate. (Ensure hopper vent is open.)

c) Start bucket elevator.

Check fuel bin level alarm. Repeat steps **a-c** until the bin indicates full (should require about 3 loads), then stop the bucket elevator.

There is an alternative method for filling the bin which does not involve the bucket elevator.

d) Fill the smaller fuel bin loading hopper. The same two methods are provided as in **a** above.

e) Discharge hopper contents into the top of the fuel bin.
Rig and hoist the hopper to the top of the fuel bin. Open the 300 mm diameter auxiliary loading flange, position hopper over the opening, and open the hopper discharge gate (ensuring the vent is open).

f) Repeat until bin is full - approximately six loads should be required.

When the bin is filled, ensure that all bin openings and gates are closed. The system is now ready for operation.

Sorbent Bin

There are two methods of loading limestone into the limestone storage bin.

a) Transport limestone drums to the loading area. Approximately three drums should be required.

b) Open the limestone separator gate.

c) Insert the suction lance into a drum and start the limestone blower. The limestone separator rotary valve should also start.

d) Manipulate the lance until the drum is evacuated.

Check the limestone bin level alarm. Repeat steps **c** and **d** until the bin indicates full (this should take about 70 minutes). Then shut off the limestone blower. Ensure all bin inlet openings are closed.

There is an alternate method for filling this bin, using the fuel bin loading hopper and discharging into the top of the bin. The procedure is essentially identical to that described in **d** to **f** of the previous section.

If manpower is available, both these operations can be conducted concurrently to reduce the overall time required.

5.3 Start-up

a) Perform pre-start check of the system.

b) Pre-start operations:

- Fill fuel and sorbent bins (see section 5.2)
- Set baghouse on bypass
- Set flue gas cooler on bypass
- Fill cooling tower remote sump
- Ash collection bins in place
- Desired transfer conveyor in place
- Fill and pressurize cooling system
  - o Open make-up water valve and vent valves
  - o Start circulating pump
  - o Shut vents when steady water flow starts
  - o Shut make-up valves when pump discharge pressure reaches (TBD)
- Close gates on:
  - o Flue gas cooler ash discharge
  - o Baghouse hopper
  - o Transfer conveyor sand chute inlet
  - o Fuel and sorbent bin inlets
- Set cooling water flows
  - o There is no initial manual flow adjustment for the bayonet tubes and flue gas cooler. The cooling surface is adjusted.
  - o Isolate and remove bayonet tube(s) to effect initial performance reduction.
  - o Isolate part of the flue gas cooler surface to effect similar reduction.
  - o Adjust discharge globe valves at the bed drain cooler and No. 2 transfer conveyor. Flows can be determined at local rotameters.
- Set bayonet tubes to proper insertion depths to give desired heat removal rate.

c) Start cooling tower pump. Intake and discharge louvers in cooling tower enclosure should automatically open.

d) Start cooling tower fan.

e) Start I.D. fan

f) Start F.D. blower

g) Set initial airflows:

- Primary air at 313 kg/hr (150 SCFM)
- Secondary air at 0
- L valve purges at 12-21 kg/hr (6-10 SCFM) **(TBV)**
- Feed chute transport air at 104 kg/hr (50 SCFM) **(TBV)**
- Igniter at **(TBD)**
- Pressure taps at 850 l/hr (30 SCFH)
- Flyash recycle at 0.

h) Purge combustor for 2 to 5 minutes at 0.6-0.9 m/sec (2-3 ft/sec) bed velocity with about 313 kg/hr (150 SCFM) primary air. Set I.D. fan to balance draft at top of combustor.

i) Feed sand or spent bed material into combustor. Start-up bed inventory is about 45-90 kg. An additional 45-90 kg of sand may be required to provide a seal for the L valve if the recycle loop has been drained. Minus 16 mesh to 30 mesh sand is recommended.

- Start transfer conveyor and feed chute rotary valve (if using No. 1 transfer conveyor only)
- Open gates on sand inlet and feed chute and feed bed material. Close sand inlet gate when feeding completed.

j) Start ignition burner (after purge cycle)

k) Increase bed temperature at the rate of **(TBD)** (as recommended by refractory supplier) to minimize thermal shock to the refractory liner until the ignition temperature of the fuel is reached and stable combustion achieved.

l) Start fuel feed:

- Open all slide gates
  - o Fuel bin discharge
  - o Limestone bin discharge
  - o Weighfeeder discharge (fuel and limestone)
- Control settings:
  - o Place fuel and limestone controllers on manual at 0% output
  - o Place weighfeeder local controls on manual
  - o Enter the fuel heating value into the fuel controller
  - o Enter the desired limestone/fuel ratio setpoint into the limestone controller
  - o Enter the desired air/fuel ratio into the total air controller
- Start fuel bin discharger
- The weighfeeders are ready for operation on manual local control

m) Accelerate bed temperature, if required, by mixing in 2.3-4.5 kg (5-10 lb) batch of fuel when the bed temperature has reached the safe fuel ignition temperature of 550-700°C (1000-1300°F), depending upon fuel reactivity. For non-volatile fuel, safe fuel ignition temperature could be 800°C (1450°F).

Operate the fuel weighfeeder on manual. The weighfeeder rotary valve should also operate.

CAUTION - DO NOT OVERFEED FUEL. Observe flue gas emissions (SO_2, CO, CO_2 and O_2) for combustion trend. Overfeeding may cause accumulation of devolatized fuel, which at the right temperature could spontaneously ignite. This could cause an over temperature transient, resulting in the formation of a fused ash bed, as well as thermal spalling of the refractory liner.

n) Once combustion in the bed is established, shut off the ignition burner and start fuel feed to increase combustion and attain the desired bed temperature of 840°C (1550°F) for coal combustion.

- Bring fuel weighfeeder up to minimum stable speed
- Place both weighfeeder controls on remote (or auto)
- Set fuel feedrate manually, on the fuel controller

- While fuel feed is increasing, increase primary airflow (still in manual) to maintain flue gas 0_2 at 2-3%.

o) Build bed inventory until pressure drop reaches at least 8.7-10 kPa (35-40 in WG) by adding sand, spent bed or limestone.

p) Set desired superficial velocity by:

- Ramping primary air to 50-80% of total combustion air. Proportion of primary air will be dependent on fuel type and desired test conditions.
    - o Set the secondary air controller in manual at 0% output and input desired secondary/total air ratio
    - o Manually bring secondary air flow to the desired value. This must not be done too rapidly or the total airflow rate will be upset.
    - o The secondary air can be introduced at more than one level. This is done by adjusting manual valves and monitoring rotameters.
- Loop seal and feed chute purges are also part of the secondary air, and should be set at desired values.
    - o Total loop seal air flow is set at the loop seal air flow controller.
    - o Loop seal air distribution is set at manual valves.
    - o Feed chute purges are set at manual valves.
- If the desired bed temperature cannot be reached at the desired superficial velocity, the bayonet tube length should be adjusted until bed temperature is within the desired range.

q) Transfer plant combustion controls to automatic

- Check that the actual secondary/total air and air/fuel ratios are approximately equal to the setpoint values.
- Adjust the plant master station output to match the current firing rate.
- Place weighfeeder and total air controllers in auto:
    - o Combustor temperature is now automatically adjusted by the plant master only.
    - o Flue gas oxygen is now trimmed by the air/fuel ratio station only. This will not normally require further adjustment as the plant master adjusts air and fuel flows in parallel.

r) Bed pressure drop (grid to combustor top) should stay within 10-20 kPa (40-80 in WC). Open gate and start bed drain cooler. Adjust speed as necessary to maintain desired bed pressure drop.

s) Start baghouse fly ash collection.

- Open hopper outlet gate.
- Start baghouse rotary valve. Set speed to desired setting.
- Set diverter valve to direct fly ash to collection bin.
- Set fly ash recycle airflow to desired value for ash collection.

t) Good circulation is normally indicated by a uniform temperature profile across the height of the combustor. Recirculating loop temperature also gives indication of good solids recirculation.

u) Cooling system controls may be transferred to auto at this point. Adjust setpoints to the desired temperatures at the bayonet tubes and flue gas cooler.

5.4 Steady State Operation

a) When the desired test conditions (temperature range, superficial velocity, offgas concentrations, etc.) are reached, the steady state conditions are maintained by the following control systems:

- Firing rate:
  - Fuel feed
  - Fuel/limestone ratio
- Air system:
  - Air/fuel ratio
  - Secondary/total air ratio
  - Air header pressure
  - Secondary air distribution
  - Loop seal air flow
  - Fly ash reinjection air flow
- Combustor pressure
  - Combustor pressure controller
  - Bed drain flow rate

- System temperature control
  - o Bayonet tube water flow
  - o Bayonet tube insertion depth
  - o Fuel feed
  - o Fuel gas cooler water flow
  - o Flue gas cooler partial bypass (TBD)
  - o No. 2 transfer conveyor water flow
  - o Bed drain cooler water flow
  - o Heat exchanger bypass
  - o Cooling tower (internal) modulating capacity control dampers
- Flue gas emissions
  - o Excess air (0_2)
  - o SO_2
  - o NO_x, CO and CO_2

b) Firing rate:

- Firing rate is controlled by the plant master, which adjusts fuel and air flows in parallel. Both flows are cross limited to prevent a fuel rich mixture (on firing increase air flow increases before fuel, on firing decrease, fuel flow decreases before air).
- Fuel flow is controlled by the fuel controller to a setpoint from the plant master.
  - o The fuel bin activator is operated to maintain a steady flow from the fuel bin (operation TBD).
  - o Limestone flow is controlled by the limestone controller to a limestone/fuel ratio setpoint in the fuel controller.

c) Air system:

- Total air flow is controlled by the plant master to an air/fuel ratio setpoint.
- Secondary air flow is controlled by the secondary air controller to a secondary/total air ratio setpoint. Rate of change of this setpoint must be limited to avoid air system upset.
  - o If primary air flow falls below a low limit (indicated by low primary air flow alarm) a combustor fuel trip will result.

- Air header pressure is controlled by the bypass valve controller to a normal pressure of 69 kPa (10 psig).
- Secondary air distribution is set by manual valves equipped with rotameters.
- Loop seal air flow is set by the loop seal air controller, which can supply a constant flow rate against varying backpressure.
    - o Loop seal air distribution is set by manual valves at the loop seal.
- Flyash reinjection air flow is set and controlled at the flyash reinjection air controller.

d) Combustor pressure:

- Pressure at the top of the combustor is controlled by the combustor pressure controller to near atmospheric by modulating the I.D. fan inlet damper.
- Combustor pressure drop is monitored at a control panel indicator and should be maintained at 8.7-20 kPa (35-80 in WC) by periodic or continuous operation of the bed drain cooler.
- The following alarms and indications signal the requirement for corrective action:
    - o High combustor pressure - further increase will result in fuel trip
    - o High baghouse differential pressure will initiate baghouse cleaning cycle (TBD)
    - o Cyclone outlet to loop seal differential pressure must be monitored. Normal reading is 12 kPa (48 in WC). An increase to approximately 20 kPa (80 in WC) signals a blockage in the recycle loop.

e) System temperature control:

- Combustor bed temperature is monitored at the combustor to cyclone cross duct and controlled by bayonet tube insertion depth, bayonet tube water flow and fuel firing rate.
    - o Bayonet tube insertion depth is preset and not changed during normal operation. Only on shut-down of the air system can the bayonet tube sealing clamps be loosened.
    - o Bayonet tube water flow is controlled within a 10% range (TBD) of the normal 66°C (150°F) by the bayonet tube cooling water temperature controller.

    - Bed temperature can also be modulated by adjusting the fuel firing rate.

- Flue gas cooler cooling water temperature is controlled by cooling water flow and by removing a portion of the cooling surface (TBD).

    - Cooling water temperature is fine tuned within a (TBD) range by the flue gas cooler cooling water temperature controller to maintain the flue gas temperature at the outlet of the cooler at 177°C (350°F).
    - Gross adjustment of this temperature is effected by removing a portion of cooling surface (TBD).

- Transfer conveyor No. 2 and bed drain cooler cooling water flows are monitored by rotameters and adjusted by manual valves.

- The cooling system water temperature is controlled by cooling tower water temperature to the heat exchanger and by cooling system water automatic bypass around the heat exchanger.

    - For rapid system warmup, the temperature bypass valve can be manually opened during startup, and returned to automatic control when operating water temperatures are reached.

    - Cooling water temperature is modulated automatically by the (internal) fan capacity control dampers. If ambient temperatures are sufficiently low, the fan motor can be shut off - there should still be some natural draft through the cooling tower.

- The following alarms and indications signal the requirement for corrective action:

    - High combustor pressure - further rise will result in fuel trip.
    - High flue gas temperature at baghouse inlet -further inlet may damage the filters.
    - Bayonet tube low water flow alarms - these are set to alarm at 24 L/min or 50% of normal flow. If inlet flow is at normal value this will indicate a tube rupture.

f) Flue gas emissions:

- Flue gas oxygen (excess air) is adjusted by varying the air/fuel ratio.

- Flue gas SO_2 is adjusted by varying the limestone/fuel ratio.
- Flue gas CO and NO_x are adjusted by varying the level and amount of secondary air.

g) Baghouse fly ash recycle:

- Open gate valve at the combustor on the fly ash recycle line.
- Set the diverter valve to direct fly ash to the combustor.
- Set fly ash recycle airflow to desired value for fly ash reinjection.

5.5 Shut-Down

Normal Shut-Down Procedure

a) Stop fuel and limestone weighfeeders.

b) Maintain solid circulation with air at **(TBD)** kg/hr.

c) Allow combustor to cool at **(TBD)** °C/hr.

d) Maintain cooling water flows.

e) Stop bed drain cooler.

f) Cool bed to 200-260°C (400-500°F), then slump bed by tripping I.D. fan and F.D. blower.

Shut-Down Without Combustor Cooling

To be used if combustor heat rentention is desired, say for next day start-up, to keep the bed hot and save start-up time.

a) Stop fuel and limestone weighfeeders.

b) Slump bed by tripping I.D. fan and F.D. blower and close air system dampers and valves and I.D. fan inlet damper.

c) Maintain bayonet tube cooling water flow.

Combustor Fuel Trip Logic

Any one of the following will result in a combustor master fuel trip taking place.

a) Combustor high pressure

b) Combustor high average temperature

c) FD blower not running (tripped or stopped)

d) I.D. fan not running (tripped or stopped)

e) Primary air flow low

f) Unit failure in any of the microprocessor based controllers

g) Both master trip pushbuttons on the panel pressed.

The master fuel trip results in:

- tripping at full system by an immediate trip of the transfer conveyor in service and the feedchute rotary valve. Upstream components in the fuel system (feeders, rotary valves, bin activator) trip immediately by a cascade trip.
- Trip of ignition burner fuel.

SECTION 6.0

DRAWING LIST

6.0 DRAWING LIST

Drawing Number	Title
G.A. Technologies	
3100-001	Combustor Assembly
3100-002	Combustor Bottom Subassembly
3100-003	Distributor Plate
3100-004	Combustor Top Subassembly
3100-005	Bayonet Tube
3100-006	Combustor L-Valve Subassembly
Mechanical	
AO-0243-4601	Process and Instrumentation Diagram
AO-0243-4701	General Arrangement - Ground Floor and Platform El. 2300
AO-0243-4702	General Arrangement - Platform El. 4700 and 7700
AO-0243-4703	General Arrangement - Section A
AO-0243-4704	General Arrangement - Section B
AO-0243-4705	General Arrangement - Section C and D
AO-0243-4706	General Arrangement - Penthouse and Bayonet Tube Removal System
AO-0243-4707	General Arrangement - Cooling Water System, F.D. Fan, Stack and Blowers
AO-0243-4801	Piping Arrangement - Ground Floor and Platform El. 2300
AO-0243-4802	Piping Arrangement - Platform El. 4700 and 7700
AO-0243-4803	Piping Arrangement - Section A
AO-0243-4804	Piping Arrangement - Section C and D
B-0243-SK231-2	Fuel Loading and Feed Chutes
B-0243-SK172-1	Flue Gas Breeching - Refractory Lined Duct Section
Electrical	
A1-0243-6101	One Line Diagram
A1-0243-6201	Block Diagram - Power and Control
A1-0243-6202	Block Diagram - Instrumentation
A1-0243-7301	Schematic Diagrams
A-0243-7601	Motor List - Sheet 1 of 2
A-0243-7602	Motor List - Sheet 2 of 2

Drawing Number	Title
Instrumentation	
B-0243-8101	Logic Diagrams - Symbols and Definitions
B-0243-8102	Logic Diagrams - I.D. Fan, Circulating Water Pump, Cooling Tower Pump, Bucket Elevator, Limestone Separator Rotary Valve, Limestone Blower
B-0243-8103	Logic Diagrams - Transfer Conveyors No. 1 and 2, Feed Chute Rotary Valve, Bed Drain Cooler, Baghouse Rotary Valve
B-0243-8104	Logic Diagrams - F.D. Blower, Fuel Bin Activator, Master Trip
B-0243-8105	Logic Diagrams - Weighfeeder and Weighfeeder Discharge Rotary Valve
A-0243-8301-002	Loop Diagram - Combustor Air Header Pressure
A-0243-8301-003	Loop Diagram - Combustor Air Header Temperature
A-0243-8301-004	Loop Diagram - Total Air to Combustor - Flow
A-0243-8301-007	Loop Diagram - Primary Air - Flow
A-0243-8301-008	Loop Diagram - Primary Air - Windbox Pressure
A-0243-8301-009	Loop Diagram - Secondary Air Before Flow Element - Pressure
A-0243-8301-010	Loop Diagram - Secondary Air - Flow
A-0243-8301-017	Loop Diagram - Loop Seal Air - Flow
A-0243-8301-018	Loop Diagram - Flyash Recycle Air - Flow
A-0243-8301-021	Loop Diagram - Fuel Bin - Level
A-0243-8301-022	Loop Diagram - Fuel Bin - Level
A-0243-8301-023	Loop Diagram - Fuel to Combustor - Flow
A-0243-8301-024	Loop Diagram - Fuel Feeder - Flow
A-0243-8301-025	Loop Diagram - Limestone Bin - Level
A-0243-8301-026	Loop Diagram - Limestone Bin - Level
A-0243-8301-027	Loop Diagram - Limestone to Combustor - Flow
A-0243-8301-028	Loop Diagram - Limestone Feeder - Flow
A-0243-8301-030-042	Loop Diagram - Combustor Temperatures - Sheet 1
A-0243-8301-030-042	Loop Diagram - Combustor Temperatures - Sheet 2
A-0243-8301-043	Loop Diagram - Fluidized Bed (Above Distributor) Pressure

Drawing Number	Title
A-0243-8301-051	Loop Diagram - Combustor - Pressure
A-0243-8301-052	Loop Diagram - Combustor - Pressure
A-0243-8301-053	Loop Diagram - Combustor Outlet Duct to Cyclone - Temperature
A-0243-8301-055	Loop Diagram - Cyclone - Temperature
A-0243-8301-057	Loop Diagram - Recycle Loop Before Aeration Ports - Temperature
A-0243-8301-060	Loop Diagram - Recycle Loop After Aeration Ports - Temperature
A-0243-8301-062	Loop Diagram - Cyclone Gas Outlet - Pressure
A-0243-8301-063	Loop Diagram - Cyclone Gas Outlet - Temperature
A-0243-8301-064	Loop Diagram - Distributor - Differential Pressure
A-0243-8301-065	Loop Diagram - Fluidized Bed Base to Combustor Outlet - Differential Pressure
A-0243-8301-066	Loop Diagram - Flue Gas Cooler Outlet - Pressure
A-0243-8301-067	Loop Diagram - Flue Gas Cooler Outlet - Temperature
A-0243-8301-068	Loop Diagram - Flue Gas Cooler Outlet - Temperature
A-0243-8301-070	Loop Diagram - Baghouse Flue Gas - Differential Pressure
A-0243-8301-072	Loop Diagram - I.D. Fan Gas Inlet - Temperature
A-0243-8301-074	Loop Diagram - Cooling Tower Remote Sump - Makeup Water Temperature
A-0243-8301-075	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-076	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-079	Loop Diagram - Cooling Tower Water at Heat Exchanger Inlet - Temperature
A-0243-8301-080	Loop Diagram - Cooling Tower at Heat Exchanger Outlet - Temperature
A-0243-8301-083	Loop Diagram - Plant Cooling Water Header - Temperature
A-0243-8301-085	Loop Diagram - Plant Cooling Water Header - Pressure
A-0243-8301-086	Loop Diagram - Plant Cooling Water Header - Pressure
A-0243-8301-087	Loop Diagram - Plant Cooling Water at Heat Exchanger Inlet - Temperature

Drawing Number	Title
A-0243-8301-088	Loop Diagram - Plant Cooling Water at Heat Exchanger Outlet - Temperature
A-0243-8301-089	Loop Diagram - Plant Cooling Water to Flue Gas Cooler - Flow
A-0243-8301-091	Loop Diagram - Plant Cooling Water at Flue Gas Cooler Outlet - Temperature
A-0243-8301-092	Loop Diagram - Plant Cooling Water at Bed Drain Cooler Outlet - Temperature
A-0243-8301-096	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 1 - Flow
A-0243-8301-097	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 1 - Temperature
A-0243-8301-098	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 2 - Flow
A-0243-8301-099	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 2 - Temperature
A-0243-8301-100	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 3 - Flow
A-0243-8301-101	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 3 - Temperature
A-0243-8301-102	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 4 - Flow
A-0243-8301-103	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 4 - Temperature
A-0243-8301-104	Loop Diagram - Plant Cooling Water from Bayonet Tubes - Temperature
A-0243-8301-108	Loop Diagram - Plant Cooling Water from Trans. Conv. No. 2 - Temperature
A-0243-8301-111	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 1 - Flow
A-0243-8301-112	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 2 - Flow
A-0243-8301-113	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 3 - Flow
A-0243-8301-114	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 4 - Flow
A-0243-8301-118	Loop Diagram - Cyclone Outlet to Recycle Loop - Diff. Pressure
A-0243-8301-120	Loop Diagram - Baghouse Flue Gas - Diff. Pressure
A-0243-8301-121	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-123	Loop Diagram - Combustor Average Temperature

Drawing Number	Title
A-0243-8301-124	Loop Diagram - Flyash Recycle/Disposal (3 Way Valve) Control
A-0243-8301-200	Loop Diagram - Combustion Control (Energy Input Demand)
A-0243-8401	Instrument List (46 Sheets)
A-0243-8501	Annunciator Layout
A-0243-8601	Data Logger I/O List
A-0243-8602	Data Logger I/O List
A-0243-8701	Specification Sheet - Control Valves
A-0243-8702	Specification Sheet - Control Valves
A-0243-8703	Specification Sheet - Control Valves
A-0243-8704	Specification Sheet - Control Valves
A-0243-8705	Specification Sheet - Flow Elements
A-0243-8706	Specification Sheet - Flow Elements
A-0243-8707	Specification Sheet - Flow Elements
A-0243-8708	Specification Sheet - Flow Elements
A-0243-8709	Specification Sheet - Flow Transmitters
A-0243-8710	Specification Sheet - Flow Transmitters
A-0243-8711	Specification Sheet - Flow Transmitters
A-0243-8712	Specification Sheet - Rotometers
A-0243-8713	Specification Sheet - Pressure Transmitters
A-0243-8714	Specification Sheet - Pressure Transmitters
A-0243-8715	Specification Sheet - Pressure Transmitters
A-0243-8716	Specification Sheet - Temperature Transmitters
A-0243-8717	Specification Sheet - Temperature Transmitters
A-0243-8718	Specification Sheet - Thermocouple Assemblies
A-0243-8719	Specification Sheet - Temperature Controller
A-0243-8720	Specification Sheet - Level Controller
A-0243-8721	Specification Sheet - Level Gauge (Glass)
A-0243-8722	Specification Sheet - Pressure Controller
A-0243-8723	Specification Sheet - Pressure Switches

Drawing Number	Title
A-0243-8724	Specification Sheet - Temperature Switches
A-0243-8725	Specification Sheet - Pressure Gauges
A-0243-8726	Specification Sheet - Pressure Gauges
A-0243-8727	Specification Sheet - Temperature Gauges
A-0243-8728	Specification Sheet - Level Switch
A-0243-8729	Specification Sheet - Flow Switches
A-0243-8730	Specification Sheet - Purge Meters
A-0243-8731	Specification Sheet - Pressure Regulator
A-0243-8732	Specification Sheet - Indicators
A-0243-8733	Specification Sheet - Indicators
A-0243-8734	Specification Sheet - Indicators
A-0243-8735	Specification Sheet - Recorders
A-0243-8736	Specification Sheet - Temperature Transmitters
A-0243-8738	Specification Sheet - Annunciator
A-0243-8739	Specification Sheet - Rotameters
A-0243-8740	Specification Sheet - Rotameters
A-0243-8741	Specification Sheet - Loop Power Supply
A-0243-8742	Specification Sheet - Controllers (3 Sheets)
A-0243-8743	Specification Sheet - Manual Station
A-0243-8801	Installation Details - Purged Pressure Tapping Point
A-0243-8802	Installation Details - Thermowell Installation in Small Size Lines
A-0243-9001	Shared Controller I/O List - Inputs (UIC-1)
A-0243-9002	Shared Controller I/O List - Outputs (UIC-1)
A-0243-9003	Shared Controller I/O List - Inputs (UIC-2)
A-0243-9004	Shared Controller I/O List - Outputs (UIC-2)
A-0243-9005	Shared Controller I/O List - Inputs (UIC-3)
A-0243-9006	Shared Controller I/O List - Outputs (UIC-3)
B-0243-9201	Instrument Schematic - Air System
B-0243-9202	Instrument Schematic - Fuel System and Combustion Control

Drawing Number	Title
B-0243-9203	Instrument Schematic - Combustor and Flue Gas System
B-0243-9204	Instrument Schematic - Plant Cooling System
B-0243-9401	Control Panel Layout
B-0243-9402	Control Panel Layout - Details
B-0243-9403	Control Panel Layout - Details
Civil/Structural	
AO-0243-3801	Structural Layout - Platforms and Roof Plan
AO-0243-3802	Structural and Architectural Elevations and Details
AO-0243-3803	Structural - Miscellaneous Details
AO-0243-3804	Foundation Plan and Details

SECTION 7.0

COST ESTIMATE

7.0 COST ESTIMATE

7.1 Basis of Estimate

The cost estimate provided in section 7.2 represents the total cost of the project, exclusive of final engineering and certain work to be performed by EMR (please see section 8 for discussion of this work). The equipment costs have been based where possible on vendor price estimates, although no formal tender was carried out and many of these prices were budget estimates only.

Mechanical equipment costs were based on a preliminary vendor proposal solicitation using the equipment specifications from Volume II. Comparison sheets were prepared and a single proposal was selected for the cost estimate, based on price, technical compliance with the specifications and a judgement of suitability to the application. Electrical and I & C equipment prices were similarly based on selected suppliers pricing, while other material costs as well as civil/structural/architectural estimates are based on takeoff quantity estimates and current unit prices. Labour manhours were than estimated and an assumed hourly rate of $40 applied in order to develop installation cost estimates.

Since no location was specified for the control room and MCC, all wires, conduit, etc. were taken to a point at the intersection of baylines N and 15A for the purposes of the electrical and instrumentation estimates.

All costs are in effective December 1983 Canadian dollars.

7.2 Capital Cost Estimate

The capital cost estimate is contained on the following sheets.

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EMR CANADA

ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 1 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
111-1	COMBUSTOR	(Estimated	Price)					360,000
121-1	FORCED DRAFT BLOWER			17,900	300	1,611		19,811
122	AIR PIPING			4,641	309	248		5,198
131-1	IGNITION BURNER			9,310	400	838		10,548
132	PROPANE PIPING							1,500
141-1	BED DRAIN COOLER			47,730	510	4,296		52,536
142	PIPING			1,898	95	171		2,163
151-1	BAYONET TUBE HEAT EXCHANGERS	(Included	with item	111-1)				
154	BAYONET TUBE RETRACTION SYSTEM			2,203	110	110		2,423
152-1	FLUE GAS COOLER			11,910	Incl.	1,072		12,982
153-1	WATER COOLING SYSTEM			24,200	1,700	2,178		28,078
153-2	COOLING WATER PUMPS			3,387	Incl.	305		3,692
153-3	COOLING WATER SUMP			3,695	1,000	333		5,028
155	WATER PIPING			18,380	1,838	919		21,137

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ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 2 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
161-1	BAGHOUSE			9,850	250	887		10,987
161-2	FLYASH RECYCLE ROTARY VALVE			6,902	200	621		7,723
162-1	FLYASH RECYCLE PIPING			12,026	170	1,027		13,223
163	ASH PIPING FROM FLUE GAS COOLER			720	75	38		833
171-1	INDUCED DRAFT FAN			8,225	145	740		9,110
172	FLUE GAS BREECHING			19,759	962	855		21,576
174	THERMAL INSULATION			3,583	Incl.	180		3,763
173-1	STACK			13,860	900	1,247		16,007
211-1	FUEL STORAGE AND METERING SYSTEM			36,096	600	3,249		39,945
212-1	BUCKET ELEVATOR			11,100	230	999		12,329
213-1	FUEL LOADING AND FEED CHUTES			1,200	120	60		1,380
221-1	SORBENT STORAGE AND METERING SYSTEM			30,437	450	2,739		33,626
222-1	PNEUMATIC CONVEYING SYSTEM			16,614	600	1,495		18,709
223	PNEUMATIC CONVEYOR PIPING			1,500	150	75		1,725

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ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 3 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
231-1	PORTABLE HOPPERS			5,817	250	524		6,591
241-1	FUEL TRANSFER CONVEYOR NO. 1			6,363	245	573		7,181
241-2	FEED SYSTEM ROTARY VALVE			7,302	200	657		8,159
242-1	FUEL TRANSFER CONVEYOR NO. 2			21,132	325	1,902		23,359
243	MISCELLANEOUS COMPONENTS			3,112	158	158		3,428
	TOTAL MECHANICAL EQUIPMENT							764,750
	MECHANICAL INSTALLATION	1,650MH						91,080
311	MOTOR CONTROL CENTER			10,200	Incl.	760		10,960
312	DC DRIVES TRANSFORMERS, PANEL BOARD AND							
	CONTROLLERS ENCLOSURE & LOCAL PUSHBUTTON							
	STATIONS			4,120	Incl.	220		4,340
321	POWER AND I&C WIRE AND CABLE			5,690	Incl.	300		5,990
322	CONDUIT, BOXES, FITTINGS AND SUPPORTS			8,190	Incl.	440		8,630

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EMR CANADA

ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 4 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
	TOTAL ELECTRICAL EQUIPMENT							29,920
	ELECTRICAL INSTALLATION	1,104MH	40					44,160
411	FIELD INSTRUMENTS			69,845	2,095	3,492		75,432
412	PANEL AND PANEL INSTRUMENTS			64,276	1,928	3,214		69,418
421	INSTALLATION MATERIALS			11,000	Incl.	Incl.		11,000
	TOTAL I&C EQUIPMENT							155,850
	I&C INSTALLATION	1,050MH	40					42,000
511	CIVIL WORK			14,975	Incl.	Incl.		14,975
521	STRUCTURAL STEEL			161,045	Incl.	Incl.		161,045
531	ARCHITECTURAL			16,698	Incl.	Incl.		16,698

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ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 5 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
	TOTAL C/S/A WORK							192,718
	(INSTALLATION INCLUDED)							

EMR CANADA

ARFBC RESEARCH FACILITY

COST ESTIMATE

Date July 1984
Sheet 6 of 6
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
	COST SUMMARY							
	TOTAL MECHANICAL EQUIPMENT							764,750
	TOTAL ELECTRICAL EQUIPMENT							29,920
	TOTAL I&C EQUIPMENT							155,850
	TOTAL C/S/A WORK							192,718
	TOTAL INSTALLATION COST							177,240
	TOTAL							1,320,478
	CONTINGENCY (10%)							132,048
	TOTAL COST OF PROJECT							1,452,526
	(EXCLUDING FINAL ENGINEERING AND PROJECT							
	MANAGEMENT)							

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EMR CANADA

ARFBC RESEARCH FACILITY

MECHANICAL INSTALLATION DETAIL

Date July 1984
Sheet 1 of 3
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
111-1	COMBUSTOR	184MH						
121-1	FORCED DRAFT BLOWER	27MH						
122	AIR PIPING	216MH						
131-1	IGNITION BURNER	18MH						
132	PROPANE PIPING	36MH						
141-1	BED DRAIN COOLER	9MH						
142	PIPING	18MH						
151-1	BAYONET TUBE HEAT EXCHANGERS	9MH						
154	BAYONET TUBE RETRACTION SYSTEM	54MH						
152-1	FLUE GAS COOLER	27MH						
153-1	WATER COOLING SYSTEM	36MH						
153-2	COOLING WATER PUMPS	27MH						
153-3	COOLING WATER SUMP	13MH						
155	WATER PIPING	224MH						

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EMR CANADA
ARFBC RESEARCH FACILITY

MECHANICAL INSTALLATION DETAIL

Date July 1984
Sheet 2 of 3
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
161-1	BAGHOUSE	90MH						
161-2	FLYASH RECYCLE ROTARY VALVE	14MH						
162-1	FLYASH RECYCLE PIPING	54MH						
163	ASH PIPING FROM FLUE GAS COOLER	18MH						
171-1	INDUCED DRAFT FAN	45MH						
172	FLUE GAS BREECHING	162MH						
174	THERMAL INSULATION	Incl.						
173-1	STACK	63MH						
211-1	FUEL STORAGE AND METERING SYSTEM	36MH						
212-1	BUCKET ELEVATOR	54MH						
213-1	FUEL LOADING & FEED CHUTES	18MH						
221-1	SORBENT STORAGE AND METERING SYSTEM	36MH						
222-1	PNEUMATIC CONVEYING SYSTEM	41MH						
223	PNEUMATIC CONVEYOR PIPING	72MH						

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ARFBC RESEARCH FACILITY

MECHANICAL INSTALLATION DETAIL

Date July 1984
Sheet 3 of 3
Project Ref. 0243
Prepared by GRC

WBS REF.	DESCRIPTION	QUANTITY	UNIT PRICE	MATERIAL COST	TRANSP.	DUTIES & TAXES	ERECTION COST	TOTAL COST
231-1	PORTABLE HOPPERS	Nil						
241-1	FUEL TRANSFER CONVEYOR NO. 1	18MH						
241-2	FEED SYSTEM ROTARY VALVE	12MH						
242-1	FUEL TRANSFER CONVEYOR NO. 2	Nil						
243	MISCELLANEOUS COMPONENTS	18MH						
	SUB-TOTAL LABOUR MANHOURS	1,650MH						
	SUPERVISION (@20%)	330MH						
	COST OF LABOUR	1,980MH	40				79,200	
	INSTALLATION MATERIALS (@10%)						7,920	
	EQUIPMENT RENTALS (@5%)						3,960	
	TOTAL MECHANICAL ERECTION						91,080	

SECTION 8.0

FURTHER WORK REQUIRED

8.0 FURTHER WORK REQUIRED

This report describes the second phase of the design of the ARFBC facility. The first phase was the conceptual design study mentioned in section 3. The third phase will include purchasing of the equipment specified in this phase, and refinement of the design to confirm to the actual equipment selected. As well, some work specified or requested by EMR, but beyond the scope of this contract, must be performed.

A staged program of purchasing is recommended in order to integrate the design of the selected equipment into the specifications of related or dependent equipment. For example, the cooling tower pump specifications are entirely dependent on the specifications of the selected cooling tower. This process could be simplified if a competitive tender is not performed, but in any case certified vendor information is required to finalize the specifications of some related components. The recommended staged purchasing program is described in Table 8.1. It is also recommended to group the purchase of similar items together (for example, rotary valves, and fuel and sorbent storage and metering systems) to take maximum advantage of equipment standardization.

The design will have to be revised and updated as final certified equipment design data is received. This will impact on equipment specifications as well as layout, piping and civil/structural drawings, instrument specifications and, to a lesser extent, electrical specifications.

A partial list of additional work required to completion of the project includes:

Mechanical

1) Review vendor information and revise equipment specifications as required according to the purchasing program in Table 8.1 during the purchasing stage.

2) Specify suitable overhead crane (and possibly a flue gas cooler bundle removal crane as well).

3) New loading chute for the bucket elevator (if it is to be located in a pit) and revise equipment specification.

4) Revise layout drawings, then finalize piping drawings and prepare material lists for purchasing.

5) Prepare final manuals and operating instructions after all vendor manuals received.

Electrical

1) Finalize equipment specifications (included on drawings) after final vendor information on mechanical equipment is received.

2) Prepare material lists and purchase materials and equipment.

Instrumentation and Control

1) Finalize weighfeeder controls once vendor information is received.

2) Finalize control panel design:
   - size weighfeeder insert panels
   - nameplate list plus nameplate standard drawing
   - rear of panel drawing may be required also.

3) Software block diagrams for each of the 3 microprocessor based controllers.

4) Update loop diagrams for terminal and cable numbers.

5) Update instrument list by adding instrumentation for ignition burner, baghouse and cooling tower and adding all cross references, etc.

6) Review vendor information and revise as required all instrument specification sheets for instrument ranges, setpoints and valve and flow element sizing.

7) Revise as well the annunciator list, microprocessor 1/0 list, datalogger 1/0 list and instrument schematics.

8) Prepare final operating instructions.

9) Produce instrument location drawings.

Electrical

1) Review vendor information and revise equipment specifications (contained on the electrical drawings) as required.

2) Prepare material lists.

Civil/Structural/Architectural

1) Design runway and support beams for cranes.

2) Pit for bucket elevator.

3) Modify existing platform and landing at coal bunkers.

4) New platforms in garage at elevations 4,700 and 7,620.

5) New control room.

6) Analysis of existing structure to determine capability for support of new equipment.

7) Access doorways through concrete wall at el. 4,700 and 7,700 to new platforms in garage at elevations.

8) Acoustic barrier wall at mezzanine floor.

9) Cooling tower enclosure.

10) Modify structural steel layout drawing as required and prepare steel detail and takeff drawings for purchasing.

TABLE 8.1 RECOMMENDED PURCHASING PROGRAM

LEVEL(1)	REFERENCE(3)	DESCRIPTION	COST(2)
0	111-1	ARFBC	TBA
	151-1	Combustor Bayonnet Tubes	TBA
		Level 0 Total	TBA
1	131-1	Ignition Burner	10,500
	242-1	Fuel Transfer Conveyor No. 2	23,400
		Level 1 Total	33,900
2	141-1	Bed Drain Cooler	52,500
	152-1	Flue Gas Cooler	13,000
	161-1	Baghouse	11,000
	161-2	Flyash Recycle Rotary Valve	7,700
	211-1	Fuel Storage and Metering System	39,900
	221-1	Sorbent Storage and Metering System	33,600
	241-1	Fuel Transfer Conveyor No. 1	7,200
	241-2	Feed System Rotary Valve	8,200
		Level 2 Total	173,100
3	121-1	Forced Draft Blower	19,800
	153-1	Water Cooling System	28,000
	171-1	Induced Draft Fan	9,100
	173-1	Stack	16,000
	212-1	Bucket Elevator	12,300
	222-1	Pneumatic Conveying System	18,700
	311-1	Motor Control Center	9,600
	312-1	DC Drives Transformers, etc.	4,300
	412-1	Panel plus Panel Instruments	69,400
		Level 3 Total	187,200
4	153-2	Cooling Water Pumps	3,700
	153-3	Cooling Tower Sump	5,000
	231-1	Portable Hoppers	6,600
	243	Miscellaneous Components (Balance of Spec. 251-1 to 253-1 not included in other items)	3,400
	321	Wire and Cable	5,800

TABLE 8.1 (Cont.)

LEVEL[1]	REFERENCE[3]	DESCRIPTION	COST[2]	
	322	Electrical Fittings, etc.	8,100	
	411	Field Instruments	75,000	
	521	Structural Steel	161,000	(4)
	531	Architectural	16,700	(4)
		Level 4 Total	285,300	(4)
5	122	Air Piping	5,200	
	132	Propane Piping	1,500	
	142	Bed Drain Cooler Fittings	2,200	
	154	Bayonet Tube Retraction System	2,400	
	155	Water Piping	21,000	
	162-1	Flyash Recycle Piping	13,200	
	163	Ash Piping From Flue Gas Cooler	800	
	172	Flue Gas Breeching	21,600	
	174	Thermal Insulation	3,800	
	213-1	Fuel Loading and Feed Chutes	1,400	
	223	Pneumatic Conveyor Piping	1,700	
	421	I & C Installation Materials	11,000	
	511	Civil Work	15,000	(4)
		Level 5 Total	100,800	

Notes:

(1) Purchasing Levels are defined as follows, in descending order of priority.

Level 0 - Combustor plus bayonet tubes constitute the largest item with the longest delivery and should be ordered first.

Level 1 - Immediate priority purchase. Should be purchased with Level 0 as sizing and specification will impact on combustor design.

Level 2 - Next priority. Specifications not determined by Levels 0 and 1 equipment, but may influence specifications of lower local equipment. Also long delivery equipment (6 months or greater).

Level 3 - To be purchased after specifications can be checked against certified vendor information received from higher level (0, 1 and 2) equipment.

Level 4 - Similar to above, but dependent on specifications of Levels 0, 1, 2 and 3 equipment.

Level 5 - Purchased immediately prior to construction. Should be available locally without requirement of tender.

(2) Approximate costs taken from section 7.

(3) Items referenced by dashed numbers (111-1) are described by specifications in Appendix V. All other reference numbers are cost centers only.

(4) Items 511, 521 and 531 include labour and could be purchased as supply and install contracts.

0243-0034

APPENDIX I

DESIGN STUDIES

Study of alternative pneumatic fuel loading system and alternative cooling system configurations.

Milestone Report, 15 June 1984.

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Intercontinental Engineering Ltd.

15 June 1984
File: 0243-J1

Mr. D. Desai
Combustion & Carbonization
Research Laboratory
CANMET, Energy Research Laboratories
Dept. of Energy, Mines and Resources
555 Booth Street
Ottawa, Ontario
K1A 0G1

Dear Sir:

Re: Detailed Design of an ARFBC Research Facility
DSS File No. 15SQ.23440-3-9141
Milestone No. 11 - Feasibility Study

We enclose herewith the feasibility report for the additional design study work in compliance with the requirements for Milestone 11.

The following material is enclosed with this report:

- Comparative specifications, including estimated costs
- Supplier budget price proposals
- Layout sketch
- Schematic flow diagrams

Several alternative pneumatic fuel and sorbent bin loading systems were investigated, including a vacuum system, a push-pull system and a pressurized system. The vacuum system would be preferable from a cost and operational standpoint, but large vent filters with rotary airlocks would be required above the bins, severely restricting overhead crane access. The push-pull system would collect material under vacuum, transport through the blower and discharge to the bins under pressure. This enjoys some of the advantages of both of the other systems, but would impose a large abrasive load on the blower and could experience some material cross contamination.

.../2

1155 West Pender St., Vancouver, B.C., Canada V6E 2P4 / Tel. (604) 682-7841 / Telex. 04-51296 / Cables: Vaninteg Vancouver

The pressurized system was then deemed the most favourable option, so vendor proposals were requested for a single line and a dual line system. The recommended system is the single line system proposed by Ducon-Mikropul which was the least expensive of the two, but was $9,000 or 24% more expensive than the existing system design. Schematic flow diagrams (Figures 1 and 2) illustrate the differences between the pneumatic systems, and Table 1 provides a comparison of system specifications.

Several cooling system alternatives were examined in an effort to obtain a satisfactory non-evaporative design. The options investigated were an open evaporative cooling tower with external closed circuit heat exchanger (according to the existing design), a closed circuit evaporative cooling tower and a dry air cooler. The only non-evaporative option, the dry air cooler, is unable to keep up with the cooling load during high ambient temperature conditions without resorting to massive equipment. The option considered is rated at 26.7°C (as is the open cooling tower for comparative purposes), and cooling performance will diminish as temperature rises to the 2½% summer design temperature of 30°C. This is considered unacceptable performance, and considering the $35,000 or 114% additional cost over the existing design, the alternative was deemed unfeasible. Both evaporative systems will keep up with the cooling load, although the existing design is much less expensive. The layout has been revised so that the cooling tower, sump, cooling tower spray pump and heat exchanger (if required) will be located in a separate building extension, as shown on the layout sketch, Figure 6. Except for the absence of an external heat exchanger, the closed circuit cooling tower enjoys no special advantage to justify the additional cost ($13,000 or 43%) over the existing design. It is therefore recommended that the existing design be retained, but the layout altered as described above. Comparative specifications are provided on Table 2, and schematic flow diagrams on Figures 3-5.

Copies of vendor proposals are enclosed, along with the brief specifications provided to them.

The attached page provides a list of enclosures to this report.

We trust the foregoing is to your satisfaction and look forward to discussing it with you in Ottawa.

Yours very truly,

INTEG-Intercontinental Engineering Ltd.

G.R. Cooper, P. Eng.
Project Manager

GRC/bjw
Attach.
cc: Dr. R.G. Agarwal (letter only)
Dr. R.O. McElroy (letter only)
Mr. H.H. Yip (letter only)

LIST OF ENCLOSURES

Table 1 - Pneumatic Conveying System Alternatives.

Table 2 - Cooling System Alternatives.

Figure 1 - Schematic Flow Diagram. Pneumatic Conveying System Alternative 2.

Figure 2 - Schematic Flow Diagram. Pneumatic Conveying System Alternative 3.

Figure 3 - Schematic Flow Diagram. Cooling System Alternative 1.

Figure 4 - Schematic Flow Diagram. Cooling System Alternative 2.

Figure 5 - Schematic Flow Diagram. Cooling System Alternative 3.

Figure 6 - Layout Sketch. Cooling System Layout.

Vendor Proposals:

1. Ducan-Mikropul - Pneumatic Conveying System Alternative 2.
2. Firing Industries - Pneumatic Conveying System Alternative 3.
3. G.R. Hudson Sales - Cooling System Alternative 1.
4. G.R. Hudson Sales - Cooling System Alternative 2.
5. Dehn Engineering Sales - Cooling System Alternative 3.

Performance Specifications as sent to vendors.

TABLE 1 - PNEUMATIC CONVEYING SYSTEM ALTERNATIVES

SHEET 1 OF 3

	ALTERNATIVE 1 (EXISTING DESIGN) COMBINATION SYSTEM (VARIOUS SUPPLIERS)	ALTERNATIVE 2 PRESSURIZED SINGLE LINE PNEUMATIC SYSTEM (DUCON-MIKROPUL)	ALTERNATIVE 3 PRESSURIZED DUAL LINE PNEUMATIC SYSTEM (FIRING INDUSTRIES)
1. General Description	Two different systems for dual and limestone - Bucket elevator for fuel - Vacuum penumatic conveying system for limestone.	One single system for both fuels - a pressurised pneumatic conveying system with multiple pickup and discharge points.	One pressurised pneumatic system for each material with one pickup and delivery point each, and a common blower. One tank vent for each bin.
2. Equipment Descriptions	- 0.75 kW centrifugal discharge belt type bucket elevator - 5.6 kW rotary pressure blower - 610 mm dia. bin separator - 0.37 kW 150mm rotary airlock - 75 mm I.D. piping system - Portable loading hoppers (2).	- 11.2 kW rotary pressure blower - 8.74 m^2 filter area dust collector - 0.75 kW 200 mm rotary airlocks (2) - 0.25 kW 200 mm rotary airlock - 100 mm diverter valve with electric actuator - 100 mm I.D. piping system - portable loading hopper (1)	- 11.2 kW rotary pressure blower - 6.04 m^2 filter area dust collectors (2) - 0.37 kW 200 mm rotary airlocks (4) - 75 mm I.D. piping system - portable loading hopper
3. System Cost	$ 11,100 - Bucket elevator (Stephens-Adamson) $ 16,614 - Pneumatic conveying system (Ducon-Mikropul) $ 1,000 - Piping System (Estimate) $ 4,587 - Loading hoppers (Burrard-Yarrows) $ 2,907 - FST $ 1,020 - Freight $ 37,228 - Total	41,462 - Pneumatic conveying system (Ducon Mikropul) 3,732 - FST 1,000 - Freight 46,194 - Total	45,000 - Pneumatic conveying system (Firing Industries) 2,271 - Portable loading hopper (Burrard Yarrows) 4,254 - FST Incl. - Freight 51,525 - Total

TABLE 1 - PNEUMATIC CONVEYING SYSTEM ALTERNATIVES

SHEET 2 OF 3

	ALTERNATIVE 1 (EXISTING DESIGN) COMBINATION SYSTEM (VARIOUS SUPPLIERS)	ALTERNATIVE 2 PRESSURIZED SINGLE LINE PNEUMATIC SYSTEM (DUCON-MIKROPUL)	ALTERNATIVE 3 PRESSURIZED DUAL LINE PNEUMATIC SYSTEM (FIRING INDUSTRIES)
4. Operational Sequence	Fuel - Alternative 1 - Load fuel into 700 kg capacity bucket elevator loading hopper (this can be done from another area of the plant or from the existing coal bunkers). - Hoist into position and discharge into bucket elevator. - Repeat (3 times) until bin filled. Fuel - Alternative 2 - Load fuel into the 440 kg capacity fuel bin loading hopper. - Hoist into position and discharge into the top of the bin. - Repeat (4 times) until bin filled. Limestone - Deliver material to unloading area (either in drums or loading hopper). - Transfer into sorbent bin by manipulating suction lance. - Repeat (2 1/2 drums) until bin filled.	Fuel - Load fuel into coal bunker or portable hopper. - Connect appropriate flexible hose to the single piping system. - Set automatic diverter valve to direct material to the fuel bin. - Start blower and rotary valve and feed material into bin (several hopper loads may be required). - Discharge material collected in dust collector into collection drum for disposal or reuse. Limestone - Load limestone into portable hopper. - Same general sequence as for fuel, directed into limestone bin.	Fuel - Load fuel into existing coal bunker. - Connect fuel piping system to blower at manual supply hose station. - Start blower and rotary valve and feed material into bin. - Bin vent dust is collected and fed back into conveying line - system must run until this material discharged. Limestone - Load limestone into portable hopper. - Connect limestone piping system and run system as described above.
5. Layout Requirements (L x W x H in mm)	- Bucket elevator: 286 x 845 x 9342. - Blower: (N/A) - Cyclone: 610 Ø x 1,620 (incl. airlock) - Bucket elevator loading hopper: 1,000 x 1,000 x 1,400 - Fuel bin loading hopper: 1,000 x 1,000 x 1,025.	- Blower: (N/A) - Dust collector: 915 x 915 x 3,379 - 200 mm airlocks (2): 343Ø x 559 - Loading Hopper: (N/A)	- Blower: (N/A) - Dust collectors (2): 845 x 845 x 3,608 - 200 mm rotary airlocks: 290 x 559 x 305 - Portable loading hopper: (N/A)

TABLE 1 - PNEUMATIC CONVEYING SYSTEM ALTERNATIVES

SHEET 3 OF 3

	ALTERNATIVE 1 (EXISTING DESIGN) COMBINATION SYSTEM (VARIOUS SUPPLIERS)	ALTERNATIVE 2 PRESSURIZED SINGLE LINE PNEUMATIC SYSTEM (DUCON-MIKROPUL)	ALTERNATIVE 3 PRESSURIZED DUAL LINE PNEUMATIC SYSTEM (FIRING INDUSTRIES)
6. **Advantages**	- Least expensive system. - Smallest electrical requirement. - Versatile fuel system employing either bucket elevator or direct discharge into bin. - More tolerant of fuel size and moisture. - Minimal dust problems. - Fuel and limestone bins can be filled concurrently.	- Much less material handling for fuel. - No obstruction above fuel or limestone bins (apart from piping), less restriction on crane size. - One single blower for both materials. - Requires only one person to operate.	- Much less material handling for fuel. - No obstruction above fuel or limestone bins, aside from piping, hence less restriction on crane size. - One single blower for both materials. - Less chance of cross contamination with separate piping systems for each bin. - Requires only one person to operate. - No additional handling of bin dust.
7. **Disadvantages**	- Considerable handling of material required. - Involves repeated use of crane. - Requires 2 people to operate fuel system. - Equipment (both bucket elevator and limestone bin cyclone) restricts overheat clearance, limiting crane size.	- Pressurized system can cause dust problems at system leaks. - Additional dust collector must be located somewhere. - Greater power requirement. - Additional wear and maintenance items in rotary valves (3 required). - More expensive system. - Fuel and limestone bins cannot be filled concurrently. - Bin dust must be disposed of.	- Most expensive system. - Two additional dust collectors pose awkward layout problem. - Greater power requirement. - Additional wear and maintenance in rotary valves (4 required). - Fuel and limestone bins cannot be filled currently. - More complicated piping system (for wear and obstruction).

TABLE 2 - COOLING SYSTEM ALTERNATIVES

SHEET 1 OF 2

	ALTERNATIVE 1 (EXISTING DESIGN) OPEN EVAPORATIVE COOLING TOWER WITH HEAT EXCHANGER (BALTIMORE AIRCOIL)	ALTERNATIVE 2 CLOSED CIRCUIT EVAPORATIVE COOLING TOWER (BALTIMORE AIRCOIL)	ALTERNATIVE 3 DRY AIR COOLER (YOUNG RADIATOR)
1. General Description	An open evaporation cooling tower with a closed circuit shell and tube heat exchanger. Spray water is cooled in the tower, collected in an external sump and pumped through the tube side of the heat exchanger. Circulating water is cooled in the shell side of the heat exchanger and pumped to the process.	An evaporative cooling tower with a closed circuit internal heat exchanger. Spray water is distributed over the heat exchanger in the tower and collected in an external sump. Circulating water is cooled in the tower heat exchanger and pumped to the process.	A forced draft air cooled heat exchanger. Water is cooled in the exchanger and pumped to the process.
2. Equipment Descriptions	- Open evaporative cooling tower with 15 kW centrifugal fan, modulating fan capacity control dampers and special corrosion protection. - Shell and tube external heat exchanger. - 1,830 mm dia. by 1,420 mm open external cooling tower sump tank. - 18 l/s @ 145 kPa centrifugal cooling tower pump with 3.73 kW drive. - 100 mm tower supply piping.	- Closed evaporative cooling tower 30 kW centrifugal fan, modulating fan capacity control dampers and special corrosion protection. - 2,440 mm dia. by 1,420 open external cooling tower sump. - 32 l/s @ 180 kPa centrifugal cooling tower pump with 11.2 kW drive. - 125 mm tower supply piping.	- Air cooled heat exchanger with 2 - 15 kW two speed axial fans.
3. System Cost	$ 20,460 - Model VXT-135 cooling tower and model HK8-14-2-K heat exchanger (Baltimore Aircoil) $ 2,976 - Cooling tower sump (Prorated from earlier quotation) $ 2,037 - Cooling tower pump (Earlier quotation) $ 2,006 - Allowance for cooling tower external piping $ 2,383 - FST $ 1,000 - Freight $ 30,856 - Total	$ 32,000 - Model VXI-105-IX cooling tower (Baltimore Aircoil) $ 3,705 - Cooling tower sump (Prorated from earlier quotation) $ 2,875 - Cooling tower pump (Prorated from earlier quotation) $ 1,000 - Allowance for cooling tower external piping $ 3,564 - FST $ 1,000 - Freight $ 44,143 - Total	$ 40,400 US - Model HC-1807 air cooled heat exchanger. (Young Radiator) $ 12,120 US - US exchange @ 30% $ 6,775 US - Duty @ 12.9% $ 5,337 US - FST $ 1,500 US - Freight $ 66,132 US - Total

TABLE 2 - COOLING SYSTEM ALTERNATIVES

SHEET 2 OF 2

	ALTERNATIVE 1 (EXISTING DESIGN) OPEN EVAPORATIVE COOLING TOWER WITH HEAT EXCHANGER (BALTIMORE AIRCOIL)	ALTERNATIVE 2 CLOSED CIRCUIT EVAPORATIVE COOLING TOWER (BALTIMORE AIRCOIL)	ALTERNATIVE 3 DRY AIR COOLER (YOUNG RADIATOR)
4. Layout Requirements:			
- Cooler only (L x W x H in mm)	3,660 x 1,220 x 3,350	3,970 x 2,440 x 3,350	5,790 x 2,590 x 2,740
- Enclosure area (L x W in mm)	6,860 x 4,700	6,700 x 4,570	8,230 x 5,030
5. Rated airflow, m^3/s	12.5	34	52.2
6. Capacity control	- Modulating capacity control dampers on cooling tower fan, shut off of fan. - Shutoff of cooling tower spray water system. - Modulating bypass of circulating water around heat exchanger.	- Modulating capacity control dampers on cooling tower fan, shutoff of fan. - Shutoff of cooling tower spray water system.	- Two speed motor on air cooler fans, shutoff of fans. - Modulating bypass of circulating water around air cooler.
7. Advantages	- Least cost alternative. - Will maintain cooling performance as ambient air temperature reaches summer design maximum (30°C) - Smallest cooling tower spray water requirement. - Best control of circulating water temperature during periods of low ambient temperature (fan shut off).	- Does not require an external heat exchanger. - Will maintain cooling performance as ambient air temperature reaches summer design maximum (30°C)	- Requires no auxiliary equipment (remote - sump, heat exchanger or pump and piping system). - No spray water system required - less maintenance and operation. - Good temperature control during low ambient temperature operation.
8. Disadvantages	- Requires an external heat exchanger.	- More expensive than Alternative 1. - Larger sump and tower spray water system.	- Most cost alternative. - Will not maintain cooling performance as ambient temperature approaches summer design maximum (30°C). - Largest fan power requirement. - Largest enclosure requirement.

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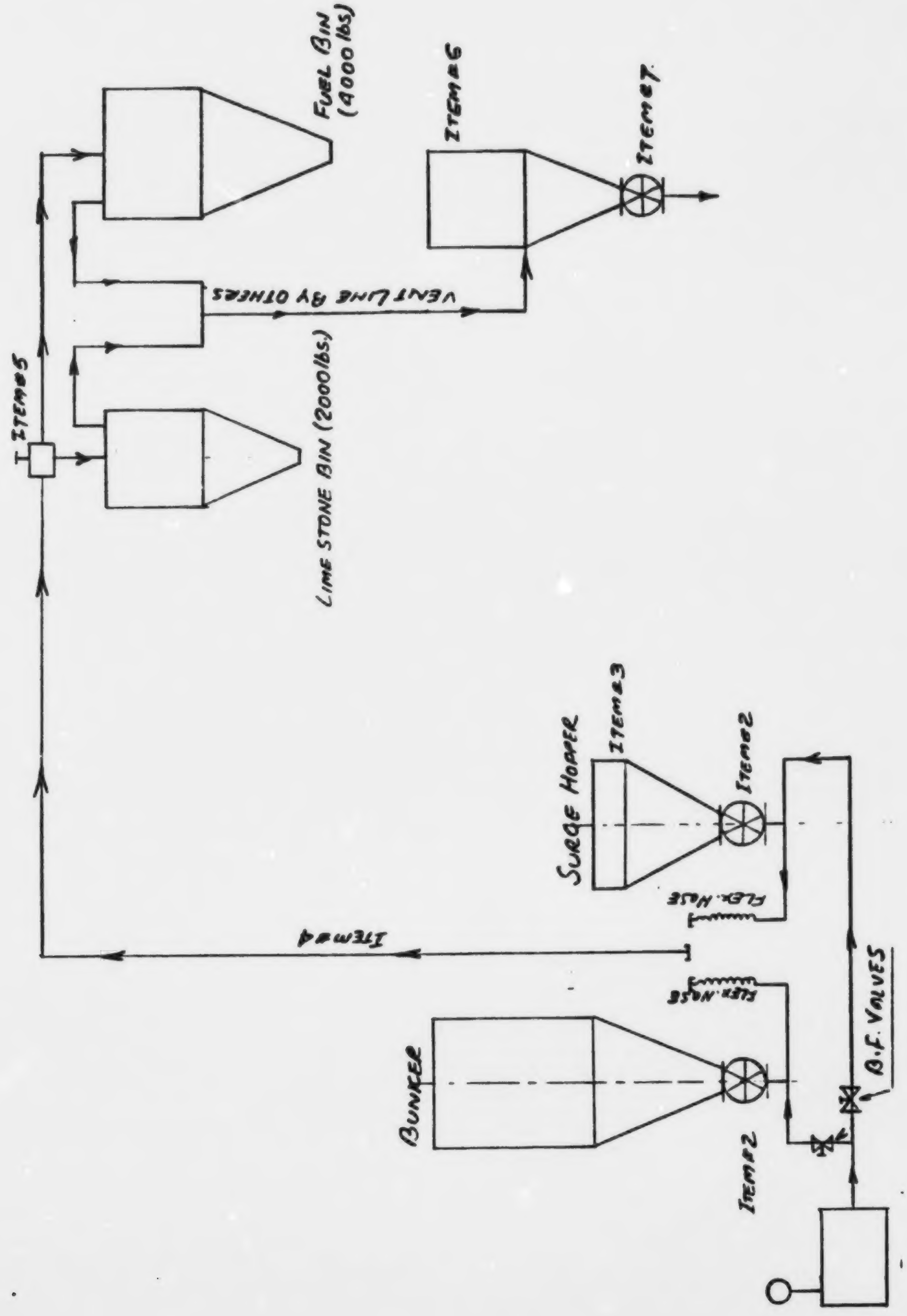
DUCON
MIKRO

DUCON-MIKROPUL LTD.
1940 Steeles Ave.E., Brampton, Ontario L6T1A7
TELEPHONE: (416) 791-3883 TELEX 069-7572

Project:	Designed by:	Date: 15/6/84
Area: SCHEMATIC FLOW DIAGRAM	Checked by:	Sheet of
Subject: PNEUMATIC CONVEYING SYSTEM ALTERNATIVE 2		File: FIGURE 1


FUEL BIN (4000 lbs)
ITEM#6
ITEM#7
VENT LINE BY OTHERS
ITEM#5
LIME STONE BIN (2000 lbs.)
SURGE HOPPER
ITEM#3
ITEM#2
FLEX. HOSE
ITEM#4
FLEX. HOSE
BUNKER
B.F. VALVES
ITEM#2

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Tlx 05-821762

Project:
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Date: 15/6/84
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Subject: PNEUMATIC CONVEYING SYSTEM ALTERNATIVE 3
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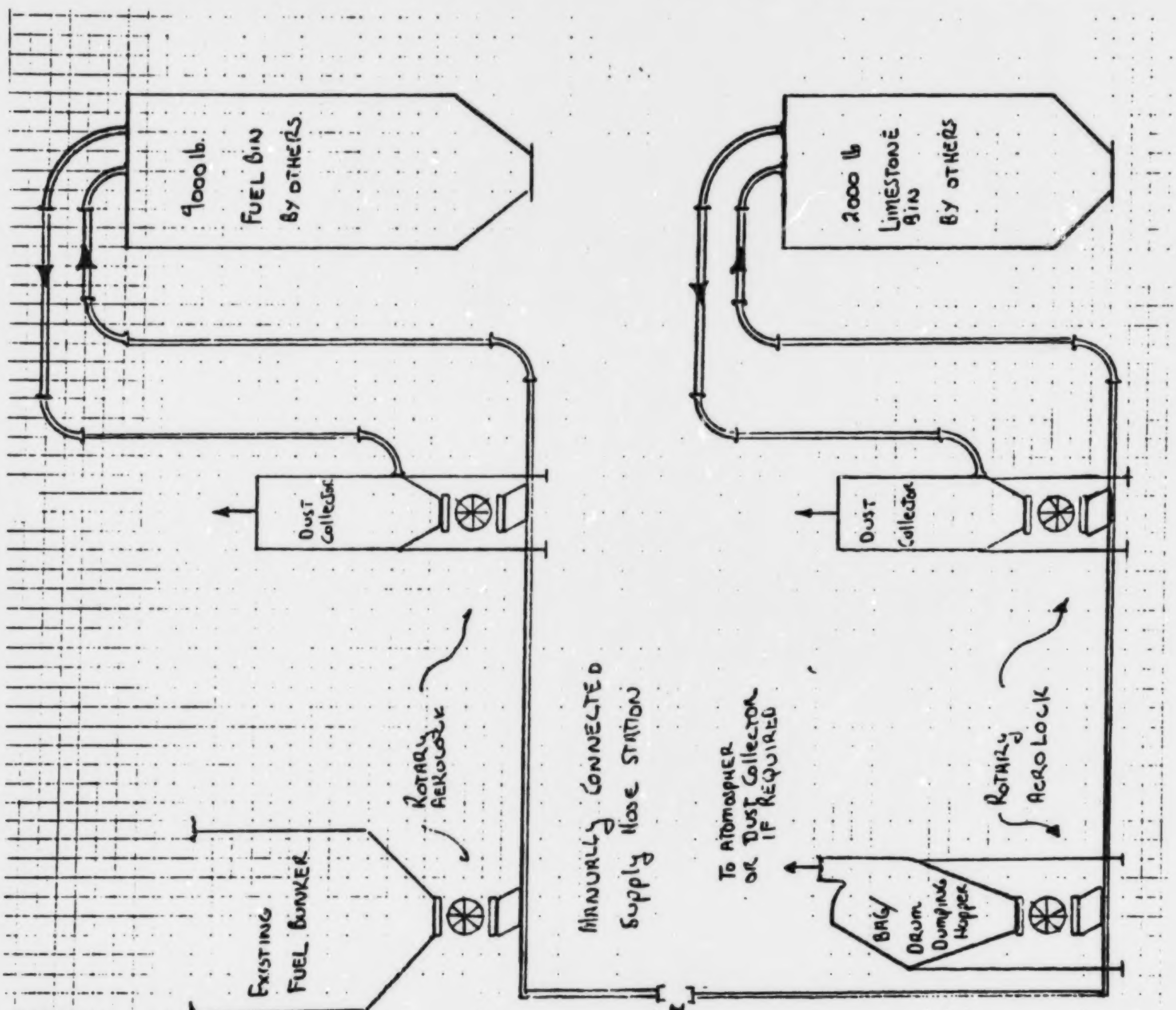
9000 lb.
FUEL BIN
BY OTHERS
2000 lb
LIMESTONE BIN
BY OTHERS
DUST COLLECTOR
DUST COLLECTOR
ROTARY AEROLOCK
ROTARY AEROLOCK
EXISTING FUEL BUNKER
MANUALLY CONNECTED SUPPLY HOSE STATION
TO ATMOSPHERE OR DUST COLLECTOR IF REQUIRED
BAG/DRUM DUMPING HOPPER
PRESSURE BLOWER
MANUAL CONTROLS.

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Calculation Sheet

Project:
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Date: 15/6/84
Area: SCHEMATIC FLOW DIAGRAM
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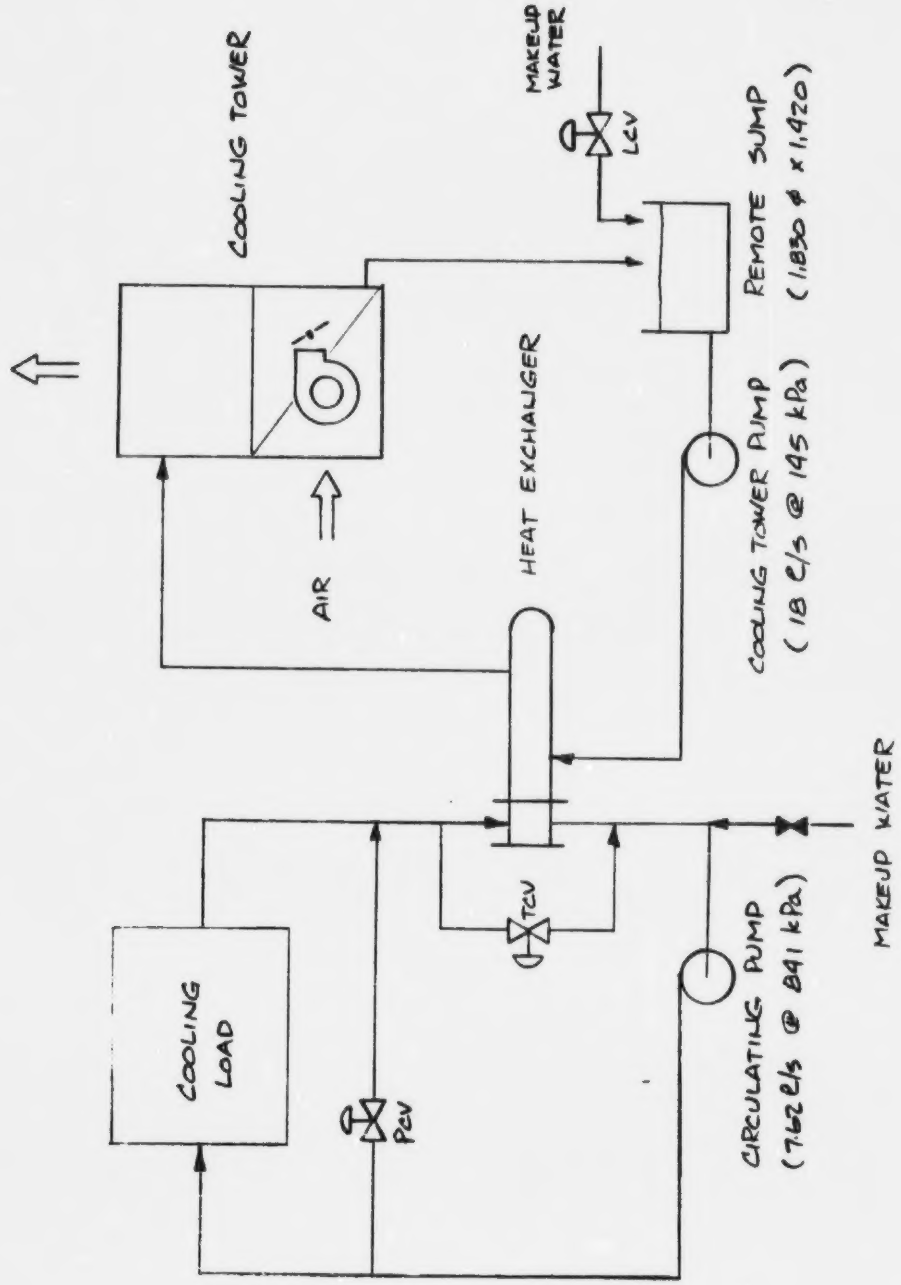
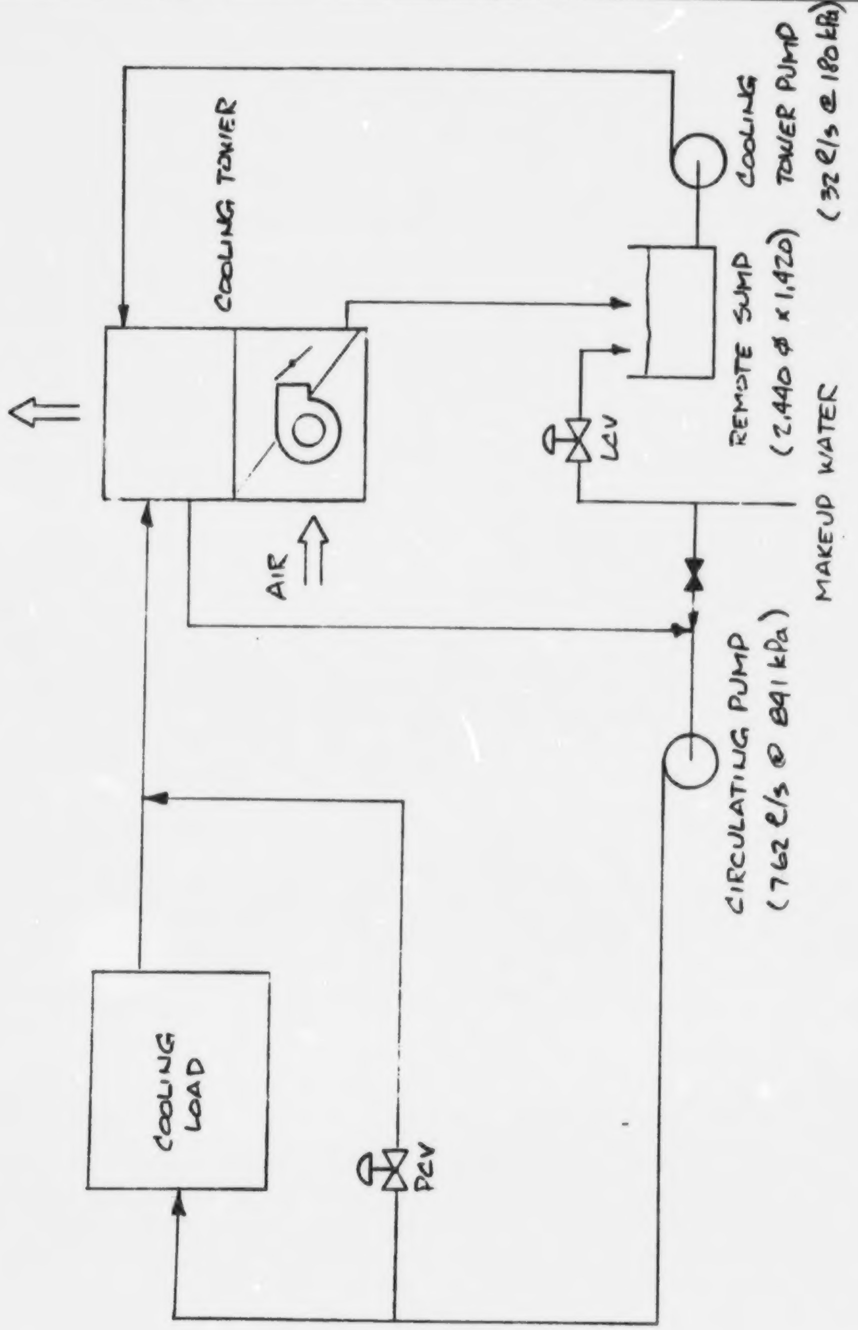
Subject: COOLING SYSTEM ALTERNATIVE 1
File: FIGURE 3


COOLING TOWER
MAKEUP WATER
LCV
REMOTE SUMP
(1,830 ϕ x 1,420)
AIR
HEAT EXCHANGER
COOLING TOWER PUMP
(18 ℓ/s @ 145 kPa)
MAKEUP WATER
TCV
CIRCULATING PUMP
(7.62 ℓ/s @ 841 kPa)
COOLING
LOAD
PCV

integ
Intercontinental Engineering Ltd

Calculation Sheet

Project:	**Designed by:**	**Date:** 15/6/84
Area: SCHEMATIC FLOW DIAGRAM	**Checked by:**	**Sheet** of
Subject: COOLING SYSTEM ALTERNATIVE 2		**File:** FIGURE 4


COOLING TOWER
COOLING TOWER PUMP (32 l/s @ 180 kPa)
REMOTE SUMP (2,440 ø × 1,920)
LCV
MAKEUP WATER
AIR
CIRCULATING PUMP (762 l/s @ 841 kPa)
COOLING LOAD
PCV

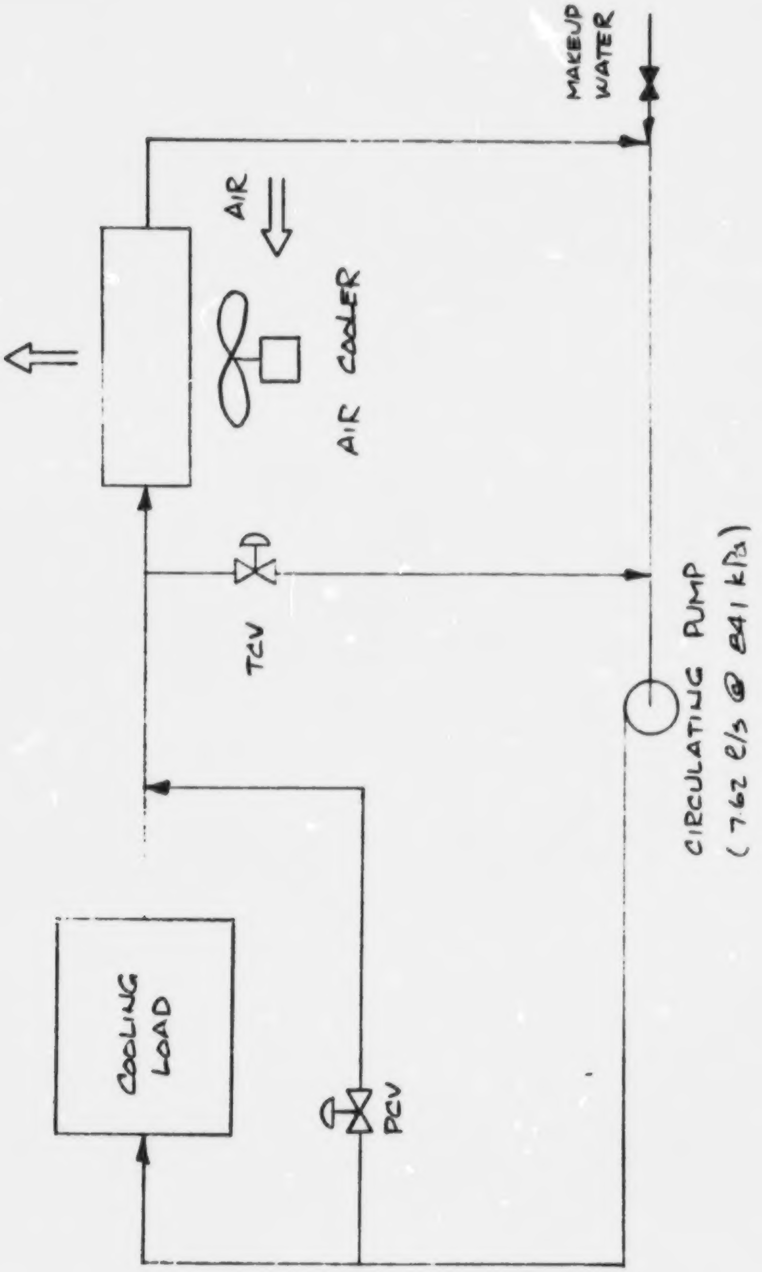
integ
Intercontinental Engineering Ltd

Calculation Sheet

Project: **Designed by:** **Date:** 15/6/84

Area: SCHEMATIC FLOW DIAGRAM **Checked by:** **Sheet** of

Subject: COOLING SYSTEM ALTERNATIVE 3 **File:** FIGURE 5


MAKEUP WATER
AIR
AIR COOLER
TCV
CIRCULATING PUMP
(7.62 ℓ/s @ 841 kPa)
COOLING LOAD
PCV

DUCON
MIKRO
DUCON-MIKROPUL LIMITED
1940 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

May 23, 1984.

integ
MAY 28 1983
GRC
DATE

Integ Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

Attention: Mr. G.R. Cooper

Gentlemen:

Subject: EMR Canada - ARFBC Research Facility
Pneumatic Conveying System File: 0243-44B
Ducon-Mikropul Proposal: S-6021

We thank you for your above inquiry and are pleased to attach our budget proposal for a Pneumatic Conveying System for your consideration.

We have designed a Dilute Phase Pressure Conveying System in order to convey coal, fluid coke and limestone in the following manner:

(a) Convey coal from bunker to fuel bin.

(b) Convey fluid coke from surge hopper to fuel bin.

(c) Convey limestone from surge hopper to limestone bin.

The system will utilize a single positive displacement blower and a main pneumatic conveying line with a diverter valve, in order to perform only one of the above operations at a time.

Both bunker and surge hopper are provided with a rotary airlock to control the material feed. Either bunker conveying line or the surge hopper conveying line will be connected to the main conveying line by a flexible hose and quick couplings based on your requirements.

The blower conveying air can be connected to the bunker line or surge hopper line by two (2) manually operated butterfly valves.

The conveying air from the fuel bin and from the limestone bin will be vented through a common dust collector.

A flow diagram is enclosed to show the proposed system.

We trust you will find our enclosed proposal to your entire satisfaction. Should you have any questions, please do not hesitate to call the under-signed.

Yours very truly,
DUCON-MIKROPUL LIMITED

Swapan Mitra
Engineering Sales.

Encl: Proposal S-6021.
Drawing D-10348
Bulletins PC-2, AL-5, 4300
Flow Diagram

/jv

DUCON-MIKROPUL LIMITED

SCOPE OF SUPPLY

Item #1: **BLOWER PACKAGE:**

One (1) only

Rotary Positive Blower Model: ROBUS RVT-61 and complete with:-
- Elevated base.
- Pressure relief valve.
- Intake filter.
- Intake silencer.
- Discharge silencer.
- Check valve.
- Pressure gauge.
- 15 H.P., T.E.F.C. motor (575/3/60).
- V-belt drive.
- O.S.H.A. guard.
- Slide base.
- Unit shipped assembled.

Item #2 **ROTARY AIRLOCK:**

Two (2) only

Ducon-Mikropul 8" PERMA/flo Type B Rotary Airlock of cast iron construction with adjustable Permalloy (550 Brinell) rotor and shoe.
Unit features outboard bearings, air purge hubs, packing gland seals, 1 H.P., T.E.F.C. (575/3/60) motor with gear reducer unit, chain and sprockets and O.H.S.A. guard.
- Unit shipped assembled.
  See bulletin 4300.

Item #3: **SURGE HOPPER:**

One (1) only

20 cu.ft. Surge Hopper, carbon steel construction, complete with material feed point and discharge and support steel.
- Shipped assembled. Structure shipped loose.

Item #4: PIPES & FITTINGS:

One (1) lot

Pipes & Fittings for the Pneumatic Conveying System comprising of:-
- 4" I.D. Sched. 40 pipes.
- Pipe couplings.
- 90° and 45° long radius bends.
- Material pick-up tees.
- Flexible hose complete with quick couplings.
- Two (2) 4" manual butterfly valves.
- Shipped loose.

Item #5: DIVERTER VALVE:

One (1) only

4" Diverter Vave, cast iron construction, complete with electric actuator and two (2) limit switches.
- Shipped assembled.

Item #6: DUST COLLECTOR:

One (1) only

Mikropulsaire Dust Collector, Model: 20S-4-30, 94 sq.ft. filter area and complete with the following items:-
- 12 ga. H.R.S. housing.
- Hopper section.
- Tubesheet assembly.
- Cast aluminum twist lock venturis.
- Twenty (20) 4'-0" long polyester bags.
- Twenty (20) 4'-0" long H.R.S. bag retainers.
- Access door.
- Solenoid valve.
- Manometer.
- Solid state timer in CEMA 12 Enclosure.
- Unit shipped assembled. Bags and retainers shipped loose.
  See bulletin PC-2 and drawing D-10348 Rev.1.

Item #7: **ROTARY AIRLOCK:**

One (1) only — 8" Size Mikro Airlock complete with cast iron housing, carbon steel rotor, outboard bushings and 1/3 H.P., T.E.F.C. 575/3/60 gear motor.

- Unit shipped assembled.
  See bulletin AL-5.

TOTAL PRICE **$41,462.00**

Items Not Included:

- Installation.
- Electrical work.
- Control panel.
- Vent lines from bins to dust collector.
- Compressed air for dust collector.

Our price is based on:-

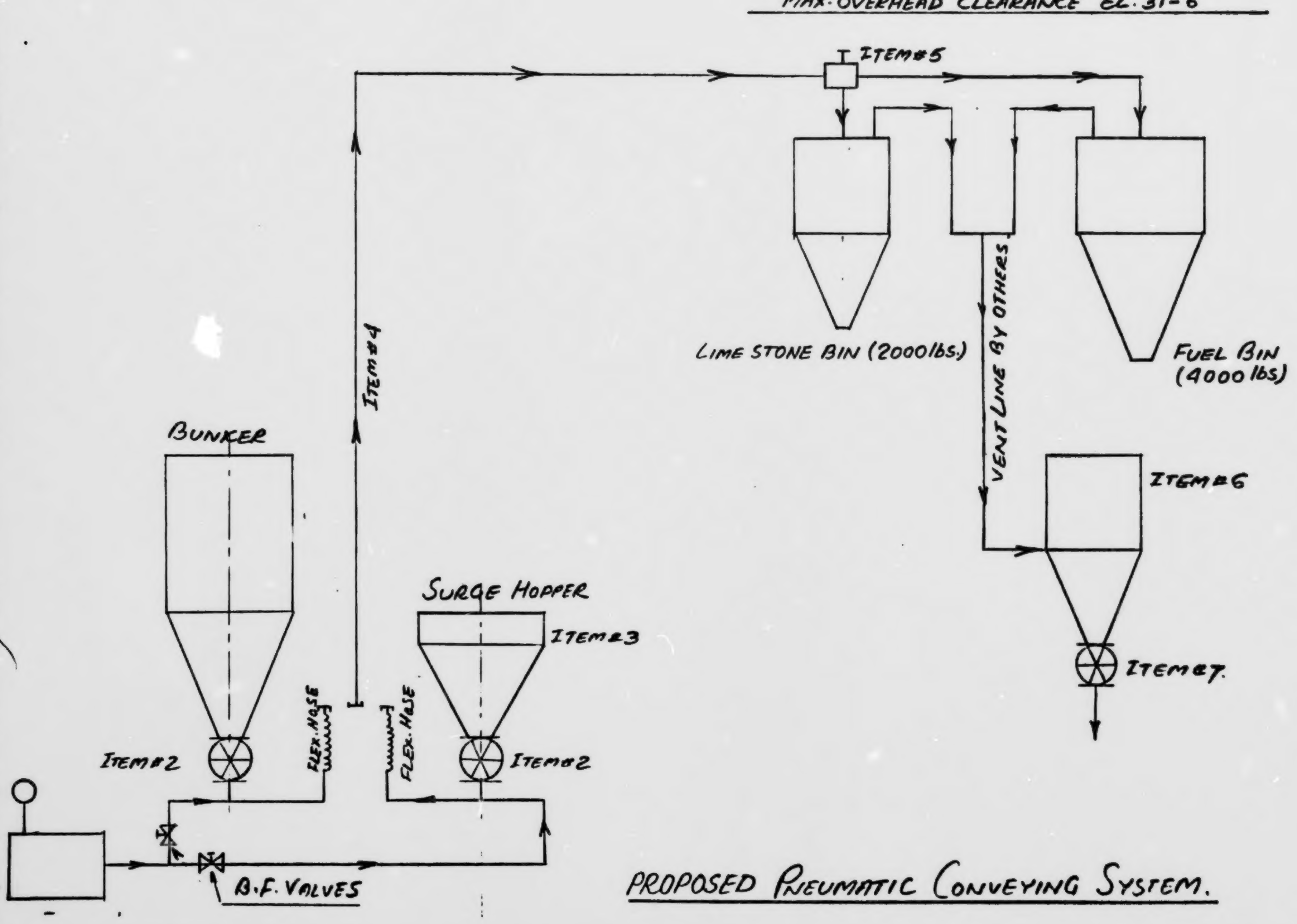
F.O.B.: Point of manufacture.

All Taxes: Extra.

Delivery: Eight (8) to ten (10) weeks after approval.

Terms: Net thirty (30) days.

Validity: Until June 25/84.


MAX. OVERHEAD CLEARANCE EL. 31'-6"
ITEM#5
LIME STONE BIN (2000 lbs.)
FUEL BIN (4000 lbs)
VENT LINE BY OTHERS
ITEM#6
ITEM#7.
ITEM#4
BUNKER
SURGE HOPPER
ITEM#3
ITEM#2
FLEX. HOSE
FLEX. HOSE
ITEM#2
B.F. VALVES

PROPOSED PNEUMATIC CONVEYING SYSTEM.

FIRING INDUSTRIES L)./LTEE
equipment for the process industries
équipement pour les industries
de transformation

FIRING

MONTREAL 6600 TRANS CANADA HWY., SUITE 750
POINTE CLAIRE H9R 4S2
TEL (514) 697-8849 TLX 05-821762

HEAD OFFICE 60 PICTON ST. P.O. BOX 230
NIAGARA-ON-THE-LAKE, ONTARIO L0S 1J0
TEL (416) 468-3272 TLX 061-5452

June 7, 1984

integ
JUN 11 1984

CIRC.	DATE
GRC	

FILE

INTEG
Intercontinental Engineering Ltd.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G. R. Cooper, P. Eng.
Project Manager

Subject: EMR CANADA ARFBC RESEARCH FACILITY
Pneumatic Conveying Systems

Gentlemen:

We are pleased to submit our budget proposal to supply the following equipment subject to the terms and conditions below delivered in Ottawa, Ontario.

APPLICATION

To convey coal and limestone at approximately 8,000 lb./hr. over an approximate distance of 30 feet horizontal and 25 feet vertical and through 4 - 90° elbows.

The attached sketch shows the system concept. This design was chosen to fit the equipment into the limited head-space available. The system would operate by having the operator connect the blower to the correct system and pushing a start button. The two rotary aerolock feeders would then start, and the material would be conveyed into the bin. The conveying air would be vented through the dust collector and any dust would be dropped back into the conveying line. When the high level indicator in the bin is reached, the supply aerolock feeder would stop. The blower and dust collector aerolock feeder would continue to operate for a set time period to clear the lines.

This proposal is based on the limited application data made available to us and is subject to an opportunity to test a representative sample of the materials to be conveyed and to a detailed review of the physical layout.

....2

BULK STORAGE — CENTRIFUGES — CONVEYORS — DRYERS — MIXERS — PULVERIZERS — SCREENS
SILOS — CENTRIFUGES — CONVOYEURS — SECHOIRS — MALAXEURS — BROYEURS — CRIBLES

It should be noted, that based on our past experience, the normal maximum particle size should only be 1/4".

EQUIPMENT

The conveying system will consist of the following components as generally described in the attached literature.

- Pneumatic Pressure Blower complete with 15 HP motor, drive assembly, inlet and outlet silencers.
- Lot of 3" Schedule 40 carbon steel conveying line.
- Automatic Control System, motor starters by others.
- Four Rotary Aerolock Feeders Model MD 98 complete with 1/2 HP TEFC gearmotor and drive assemblies.
- Two Dust Collectors Model BVC-5-65.

BUDGET PRICE, ex taxes, delivered, approx.........CAN.$45,000.00

SHIPMENT: Approximately 12 weeks after receipt of approved drawings.

TERMS: Payable with order - 1/3.
Payable 30 days after date of shipment - balance.

CONDITIONS OF SALE: The attached "Conditions of Sale" are part of this proposal.

Thank you for your continued interest in our equipment. We look forward to working with you on this project and await your instructions.

Yours truly,

FIRING INDUSTRIES LTD.

Daniel J. Feasby
Chemical Engineer

DF:jk
Encls.

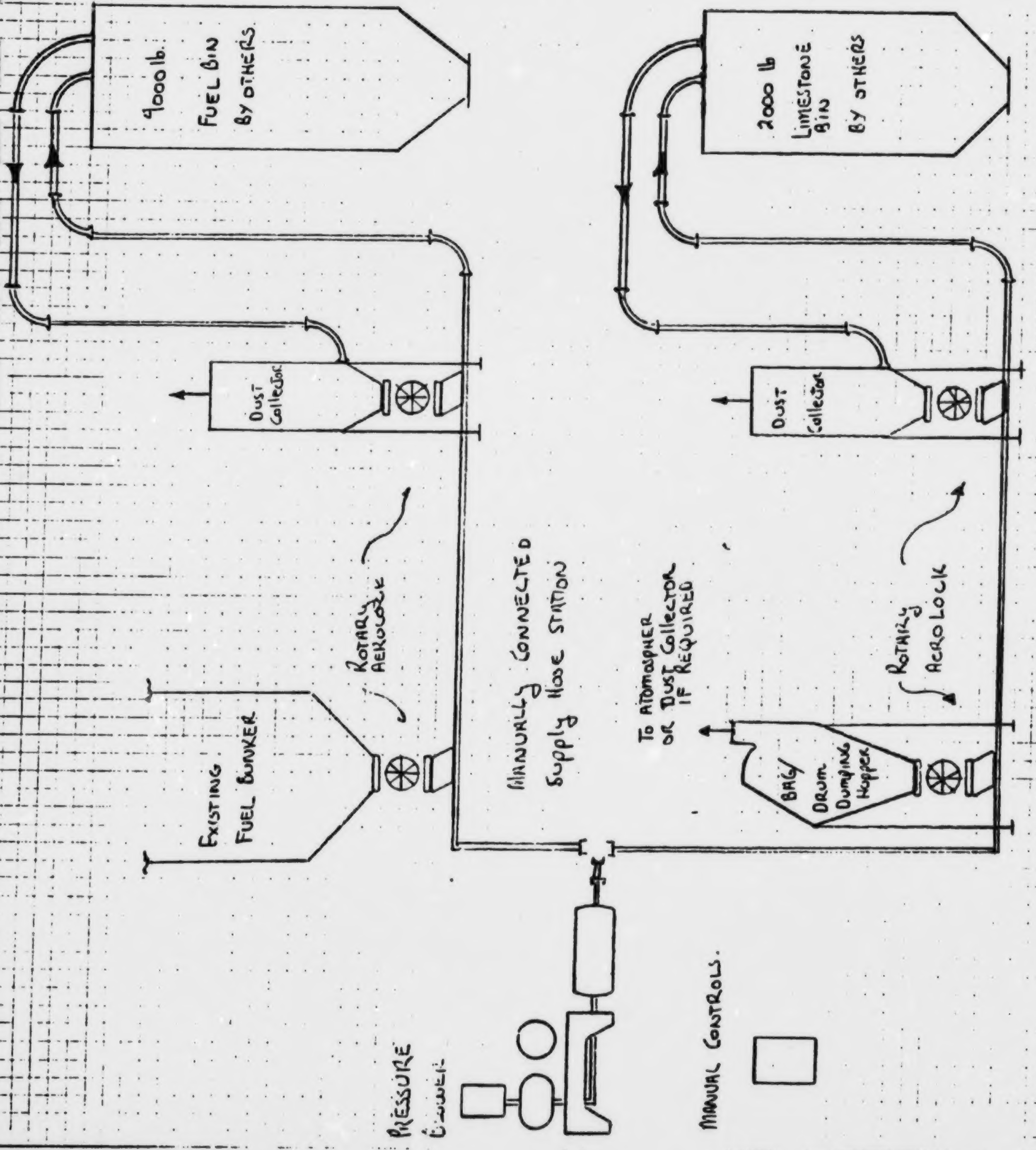
FIRING INDUSTRIES LTD.
INDUSTRIE LTÉE

equipment for the process industries
l'équipment pour les industries
de transformation

60 Picton St. P.O. Box 230
Niagara-on-the-Lake
Ontario L0S 1J0
TEL 416-468-3272
TELEX 061-5452

Montreal Tel 514-697-8849
Box C.P. 1149 Pointe Claire H9S 4H9
Tlx 05-821762

INTEG - EMR CANADA
PRELIMINARY DESIGN OF
PNEUMATIC CONVEYING SYSTEM
DJF MAY 29/84.


4000 lb.
FUEL BIN
BY OTHERS
2000 lb
LIMESTONE
BIN
BY OTHERS
Dust
Collector
Dust
Collector
ROTARY
AEROLOCK
MANUALLY CONNECTED
Supply Hose STATION
TO ATOMOSPHER
OR DUST COLLECTOR
IF REQUIRED
ROTARY
AEROLOCK
EXISTING
FUEL BUNKER
BAG/
DRUM
DUMPING
HOPPER
PRESSURE
BLOWER
MANUAL CONTROLS.

REC
MAY 16 1984
CIRC
FILE

+
INTEG VCR

BAC PACO HALT
MAY 16/84
ATT: MR GRANT COOPER

RE: EMR CANADA-ARFBC RESEARCH FACILITY COOLING TOWER

WE ARE PLEASED TO ADVISE THE FOLLOWING PRICING:

ALTERNATIVE 1:

MODEL HK8-14-2-10 HEAT EXCHANGER
HOT SIDE 110 USGPM 150/85 AT 3.5 PSIG PRESSURE DROP
COLD SIDE 259 USGPM XXXX 81.5/109 AT 6.0 PSIG PRESSURE DROP

OPERATING WEIGHT 2357 LBS

MODEL VXT-135 COOLING TOWER AT 72 DEG F WET BULB
OPERATING WEIGHT 3610 LBS

TOTAL PRICE FOR HEAT EXCHANGER AND COOLING TOWER 19,500.00
EXTRA BOR BALTIBONDED COOLING TOWER 960.00

ALTERNATE 2:

MODEL HK8-14-2-10 HEAT EXCHANGER
HOT SIDE 110 USGPM 150/85 AT 3.5 PSIG PRESSURE DROP
COLD SIDE 301 USGPM 82.6/106.2 AT 8.0 PSIG PRESSURE DROP

OPERATING WEIGHT 2357 LBS

MODEL VXT-120 XXX COOLING TOWER AT 70 DEG F WET BULB
OPERATING WEIGHT 3180 LBS

19,000.00
TOTAL PRICE FOR HEAT EXCHANGER AND COOLING TOWER 19,00.00
EXTRA FOR BALTIBONEDED COOLING TOWER 905.00

ALL TAXES EXTRAN FOB GEORGETOWN ONTARIO FREIGHT PREPAID AND ALLOWED
TO JOB SITE

NOTE: ACCESSORIES AND CONDITIONS ARE THE SAME AS OUR DEC 7/83
QUOTATION

JARY R HUDSON
G R HUDSON SALES LTD

BAC PACO HALT
+
INTEG VCR

G.R. Hudson Sales Ltd.

Telephone (604)[redacted]
P.O. Box 94305
Richmond, B.C. V6Y 2A6

June 11, 1984.

Integ-Intercontinental Eng. Ltd.,
1155 West Pender Street,
Vancouver, B.C.
V6E 2P6

Subject: Ministry of Energy, Mines & Resources,
Ottawa, Ontario.

Attention: Mr. G.R. Cooper.

Dear Sir:

We wish to submit our proposal for the Closed Circuit Industrial Cooler as manufactured by Baltimore Aircoil of Canada, in Georgetown, Ontario.

To cool 110 USGPM of water from 150°F. to 85°F. with 73°F. entering air wet bulb.

One (1) - Model VXI-105-1X	Net, $32,000.00

All Taxes Extra.
F.O.B. Georgetown, Ontario freight prepaid & allowed to jobsite.
See Attachment II for "Acceptances and Prices."

Included:

One (1) 40 HP. 575v/3/60cy fan motor with 1.15 service factor for 3/8" E.S.P.
Oversized side water outlet connection
Modulating freeze-proof capacity control dampers c/w electric damper controls
Positive closure discharge hood c/w 110 volt damper operator and linkage
BALTIBOND Four Part Corrosion Protection System

Not Included:

Vibration isolators and structural steel supports
Coil circuit pump and pump motor
Starter or disconnect switches
Rigging, hoisting or final assembly
Remote sump tank
Spray water pump
Float, make-up valve and strainer

Representing
BAC-Pritchard of Canada
Division of Baltimore Aircoil Interamerican Corp.
Affiliate of Merck & Co. Inc.
Factory Assembled and Field Erected Evaporative Cooling Products

Approximate shipping weight: 15,470 lbs.
Approximate operating weight: 18,880 lbs.

Spray water circulation is 460 USGPM with 2.0 PSI. required at the distribution header.

Pressure drop through coil 3.0.

Unit is shipped in three sections, the heaviest section weighs 12,270 lbs.
Allow 16 man hours for final field assembly.

For complete details on this proposal kindly refer to the following enclosures:

1) Physical Data Sheet
2) Mechanical Specifications
3) Standard Shop Drawing
4) Drawing BAC-6339A Positive Closure Damper Wiring
5) Drawing BAC-2045A Damper Wiring
6) Bulletin S405/1-0 VX Industrial Fluid Coolers
7) Bulletin S650/1-0 BALTIBOND

We believe this is the requested information and kindly advise if we may be of further assistance.

Sincerely yours,

Gary R. Hudson

G.R. Hudson Sales Limited
Sales Representative for
BAC-Pritchard of Canada.

Young / AIR COOLED HEAT EXCHANGER Recommendation

TO: Integ-Intercontinental Engineering Ltd.
QUOTATION NO.: Q-84139

FOR: EMR Canada -- ARFBC Research Facility
DATE: May 4, 1984

Design for	FAST SPEED	SLOW SPEED	
Model			
Rating			
Ambient. Maximum	80° F	Approx. 70° F	F
Elevation	215 feet	feet	feet
Fouling Factor	*	*	*
Circuit			
Heat Load	3,530,000 Btu Hr	Btu	Btu
Inlet Temp.	150° F	F	F
Outlet Temp.	85° F	F	F
Flow Rate	110 GPM (U.S.)		
Fluid	Water		
Pressure Loss	5.8 psi	psi	psi
Circuit			
Heat Load	Btu	Btu	Btu
Inlet Temp.	F	F	F
Outlet Temp.	F	F	F
Flow Rate			
Fluid			
Pressure Loss	psi	psi	psi
Radiator			
Model	HC-1807		
Core Code	AV-126		
Counterflow Passes	6		
Design Pressure	150 psig	psig	psig
Tube OD Wall	1/2 in. — .025 in.	in. — in.	in. — in.
Materials, Tube-Fin	Admiralty— Aluminum	—	—
Drive Arrangement	V-Belt		
(No.) Fan Type	(2) K8AL	( )	( )
Diameter	81 in.	in.	in.
Blades - Pitch	4 — 18 °	— °	— °
RPM	707 rpm	466 rpm	rpm
Tip Speed	15,000 fpm	9,880 fpm	fpm
Air Flow per Fan	55,300 scfm	36,400 scfm	scfm
HP per Fan	18 hp	5.2 hp	hp
(No.) Motor Hp	(2) 20 hp	( ) 8.9 hp	( ) hp
Enclosure-Speeds	TEFC 2		
RPM (60 Hz)	1760 rpm	1160 rpm	rpm
Voltage (3Ø)	460 V	V	V
Accessories			
Engineering charge	$900		
Total Price Each	$ 39,500 U.S.	$	$
Lot Size	1		
Shipping Weight Each	12,000 lbs	lbs	lbs
Current Leadtime	15 weeks**	weeks**	weeks**

**between receipt of drawing approval and shipment

*hr-ft² inside tube surface - F-LMTD/Btu

Note: See cover letter for terms of quotation.

Y. YOUNG RADIATOR COMPANY
GENERAL OFFICES: RACINE, WISCONSIN 53404
PLANTS: RACINE, WISCONSIN • MATTOON, ILLINOIS

Form No. 2656

integ
Intercontinental Engineering Ltd.

1- May 1984
File: 0243-44B

Ducon-Mikropul Ltd.
1940 Steeles Avenue East
Bramalea, Ontario
L6T 1A7

Attention: Mr. Swapan Mitra

Dear Sir:

Re: EMR Canada- ARFBC Research Facility
Pneumatic Conveying System

Thank you for your earlier proposal on the above job dealing with a pneumatic conveying system for limestone. As discussed over the telephone we are examining options to pneumatically convey coal and fluid coke as well as limestone.

The system is shown schematically in Figure 1 and described as follows:

Requirement

Convey coal or coke from the point of unloading to the fuel bin and convey limestone from the point of unloading to the limestone bin. May be one or two separate systems. (The separate limestone system has already been proposed).

Operation

1) Limestone is received in 45 gal. barrels and delivered to the point of unloading for introduction into the system.
2) Coal and coke are received in barrels, crates and 1 ton fiberglass bags and can be loaded into portable hoppers in another area of the facility to be brought to the point of unloading.
3) Coal and coke can also be independently loaded into large bunkers adjacent to the point of unloading.

... / 2

integ
Intercontinental Engineering Ltd.

2 May 1984
File: 0243-44B

Firing Industries Ltd.
60 Picton St.
P.O. Box 230
Niagara-on-the-Lake, Ontario
LOS 1J0

Attention: Mr. Dan Feasby, P. Eng.

Dear Sir:

Re: EMR Canada - ARFBC Research Facility
Pneumatic Conveying System

Thank you for your earlier proposal on the above job dealing with a pneumatic conveying system for limestone. As discussed over the telephone we are examining options to pneumatically convey coal and fluid coke as well as limestone.

The system is shown schematically in Figure 1 and described as follows:

Requirement

Convey coal or coke from the point of unloading to the fuel bin and convey limestone from the point of unloading to the limestone bin. May be one or two separate systems. (The separate limestone system has already been proposed).

Operation

1. Limestone is received in 45 gal. barrels and delivered to the point of unloading for introduction into the system.
2. Coal and coke are received in barrels, crates and 1 ton fiberglass bags and can be loaded into portable hoppers in another area of the facility to be brought to the point of unloading.
3. Coal and coke can also be independently loaded into large bunkers adjacent to the point of unloading.
4. The bins are generally filled once at the beginning of each day's operation, although during extended trials they may be refilled during operation.

.../2

1155 West Pender St., Vancouver, B.C., Canada V6E 2P4 / Tel. (604) 682-7841 / Telex: 04-51296 / Cables: Vaninteg Vancouver

Material Properties

Limestone: moisture - nominally dry
bulk density - 1,600 kg/m^3 (100 lb/ft^3)
size - 100% minus 6 mm (max.)
100% minus 1 mm (min.)

Fluid Coke: moisture - 3.6%
bulk density - 800 kg/m^3 (100 lb/ft^3)
size 100% 100 mesh

Coal: total moisture - 20%
max. surface moisture - 7%
bulk density - 960 kg/m^3 (60 lb/ft^3)
size - 19-13 mm - 3.04%
13- 6 mm -20.2
6- 3 mm -28.34
3 mm- 16 mesh - 16.9
16-100 mesh - 9.52
100 mesh - 0-22

(Note: coal size and moisture content can be adjusted to suit the requirements of the system).

Performance

Limestone - load 800 kg bin at rate of 0.2 kg/s.

Coal/Coke - load 1,800 kg bin at rate of 1 kg/s (based on coal).

(Note: this rate is based only on a reasonable time to fill the bin - 30 min.).

System Constraints

1. Coal properties should pose no problem as coal can be prepared prior to use.

2. Minimum handling of fine materials is desired to reduce the dusting problem.

3. Very limited clearance is available above the bins to locate filters and separators (as shown on Figure 1).

.../3

System Piping

Esimated piping requirement is approximately as follows:

	Limestone Bin	Fuel Bin
Horizontal length	23 ft.	28 ft.
Vertical length	25 ft.	25 ft.
90 degree elbows	3	3
45 degree elbows	1	1

Note: if a single system is employed to feed the two different materials, the system could be reduced to the following:

Horizontal length	23 ft.	+ 7.5 ft.
Vertical length	25 ft.	no extra
90 degree elbows	3	+ 1
45 degree elbows	1	+ 1

Note: the figures at the right are the additional quantities required for the second bin.

Information Requested

1. Recommended system.
2. Budget cost of equipment.
3. Approximate size of equipment.

Your assistance in this would be appreciated.

Yours truly,

INTEG-Intercontinental Engineering Ltd.

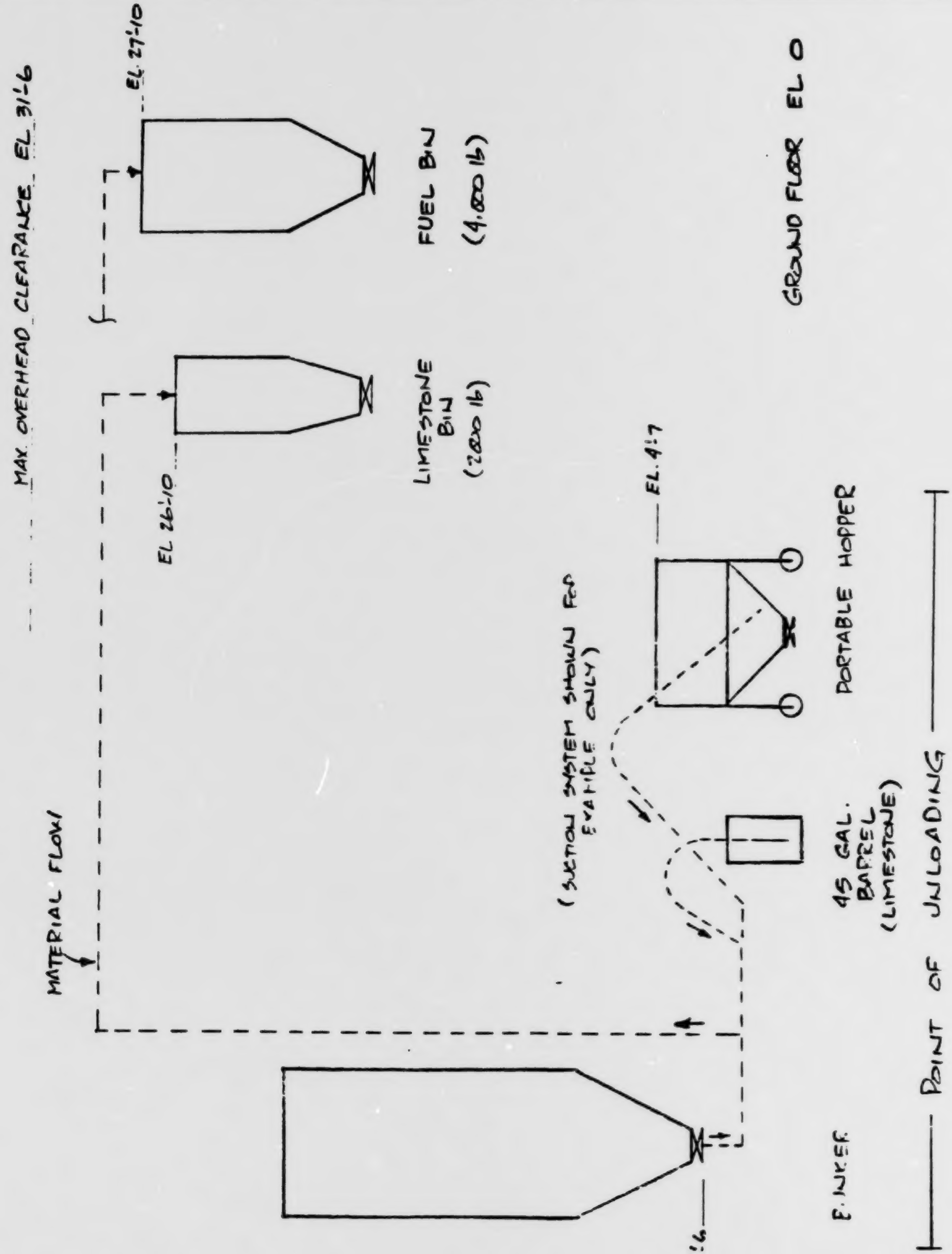
G.R. Cooper, P. Eng.
Project Manager

GRC/mpbr

integ
Intercontinental Engineering Ltd.

Calculation Sheet

Project:	**Designed by:** GRC	**Date:** APR. 27 - 84
Area: PNEUMATIC CONVEYING	**Checked by:**	**Sheet** of
Subject: FIGURE 1 - SCHEMATIC ARRANGEMENT		**File:**


MAX. OVERHEAD CLEARANCE EL 31'-6
EL 27'-10
FUEL BIN (4,000 lb)
GROUND FLOOR EL 0
LIMESTONE BIN (2800 lb)
EL 26'-10
EL 4'-7
PORTABLE HOPPER
(SUCTION SYSTEM SHOWN FOR EXAMPLE ONLY)
45 GAL. BARREL (LIMESTONE)
POINT OF UNLOADING
MATERIAL FLOW
BUNKER
EL 5'-6

CNCP TEL A VCR#
INTEG VCR
81032106

MA [illegible] -84

FILE 0343-44B

FR

FOR G R HUDSON SALES LTD, 11719 ALDERWOOD CRESCENT, DELTA

ATTN: G R HUDSON

MAY 4 1984 MSG 17

RE: EMR CANADA- ARFBC RESEARCH FACILITY
COOLING TOWER

AS DISCUSSED OVER THE TELEPHONE WE ARE CONSIDERING ALTERNTE ARRANGEMENTS FOR COOLING A CIRCULATING WATER SYSTEM. TWO TYPES OF COOLING SYSTEM ARE BEING CONSIDERED- WET AND DRY, AND TWO ALTERNATE DESIGN AMBIENT TEMPERATURES:
ALT. 1- 80 DEG F DB/72 DEG F WB
ALT. 2- 75 DEG F DB/70 DEG F WB

WE REQUEST FOUR PRELIMINARY SELECTIONS AND BUDGET PRICES FOR THE TWO TOWER TYPES AND TWO ALTERNATE DESIGN TEMPERATURES. THE SYSTEM REQUIREMENTS ARE AS FOLLOWS:

SITE DATA

- LOCATION- OTTAWA, ONT
- ELEVATION- 215 FT ASL
- SUMMER 2 1/2 PERCENT DESIGN AMBIENT TEMP- 87~~1~~ F DB/74 F WB
- WINTER 2 1/2 PERCENT DESIGN AMBIENT TEMP- 13 F DB

PERFORMANCE DATA

- FLUID COOLED- CLEAN WATER
- TEMPERATURE IN- 150 F
- TEMPERATURE OUT- 85 F
- WATER FLOW- DESIGN- 54,924 LB/HR (110 USGPM)
  NORMAL- 42,971 LB/HR (86 USGPM)
- CALCULATED HEAT EXCHANGE (DESIGN)- 3.56 MILLION BTU/HR.

NOTE- IT IS RECOGNIZED THAT SITE SUMMER AMBIENT TEMPERATURES WILL EXCEED THE TWO ALTERNATIVE AMBIENT DESIGN TEMPERATURES SPECIFIED FOR EQUIPMENT SELECTION. IT IS INTENDED TO COMPARE THE PERFORMANCE OF THE WET AND DRY COOLING TOWERS. ALSO PERFORMANCE DERATING IS EXPECTED DURING THE SUMMER WITH THE DRY SYSTEM.

YOUR EQUIPMENT SELECTION AND BUDGET COST AS WELL AS CATALOGUE DATA WOULD BE APPRECIATED.

G R COOPER
NNNN

#
CNCP TEL A VCR#
INTEG VCR

INTEG VCR

SENT

MAY 03 1984

DATE

FILE 243-44B.

06063

US TWX®
INTEG VCR

PTS
9104442266+
MOM
MOM
DESCOSEATTLE
+
INTEG VCR
MAY 3 1984 MSG 11

FOR DEHN ENGINEERING SALES

ATTN: DON DEHN

RE: EMR CANADA-ARFBC RESEARCH FACILITY
DRY COOLING TOWER

AS DISCUSSED OVER THE TELEPHONE, WE ARE EXAMING THE APPLICATION OF A DRY COOLER TO A WARM CIRCULATING WATER SYSTEM. WE ARE CONSIDERING TWO ALTERNATE AMBIENT DESIGN TEMPERATURES:

ALT 1.- 60 DEG F DB
ALT 2.- 75 DEG F DB

WE REQUEST PRELIMINARY SELECTION AND BUDGET COST FOR A SYSTEM BRIEFLY DESCRIBED AS FOLLOWS:

SITE DATA

- LOCATION- OTTAWA, ONTARIO
- ELEVATION- 215 FT ASL
- SUMMER 2 1/2 PERCENT DESIGN AMBIENT TEMP- 87 F DB
- WINTER- 2 1/2 PERCENT DESIGN AMBIENT TEMP- 13 F DB -13F

PERFORMANCE DATA

- FLUID COOLED- CLEAN WATER
- TEMPERATURE IN- 85 F
- TEMPERATURE OUT- 150 F REVERSE THESE.
- WATER FLOW- DESIGN- 54,924 LB/HR (110 USGPM)
  NORMAL- 42,971 LB/HR (86 USGPM)
- CALCULATED HEAT EXCHANGE (DESIGN)- 3.56 MILLION BTU/H

NOTE- IT IS RECOGNIZED THAT THE SITE SUMMER AMBIENT TEMPERATURES WILL EXCEED THE TWO ALTERNATIVE AMBIENT DESIGN TEMPERATURES SPECIFIED FOR EQUPMENT SELECTION. PERFORMANCE DERATING WILL BE REQUIRED AS THE TEMP. RISES.

YOUR EQUIPMENT SELECTION AND BUDGET COST AS WELL AS CATALOGUE DATA WOULD BE APPRECIATED.

G R COOPER
+
DESCOSEATTLE

INTEG VCR

SENT
MAY 0 3 1984
0743-44B

0454345
+
PATRICKVAN VCR

INTEG VCR
FOR BRUCE ST CLAIRE PATRICK LTD

ATTN: JACK MURRAY

MAY 3 1984 MSG 14

RE: EMR CANADA- ARFBC RESEARCH FACILITY
COOLING TOWER

AS DISCUSSED OVER THE TELEPHONE WE ARE CONSIDERING ALTERNTE ARRANGEMENTS FOR COOLING A CIRCULATING WATER SYSTEM. TWO TYPES OF COOLING SYSTEM ARE BEING CONSIDERED- WET AND DRY, AND TWO ALTERNATE DESIGN AMBIENT TEMPERRATURES:
ALT. 1- 80 DEG F DB/72 DEG F WB
ALT. 2- 75 DEG F DB/70 DEG F WB

WE REQUEST FOUR PRELIMINARY SELECTIONS AND BUDGET PRICES FOR THE TWO TOWER TYPES AND TWO ALTERNATE DESIGN TEMPERATURES. THE SYSTEM REQUIREMENTS ARE AS FOLLOWS:

SITE DATA

- LOCATION- OTTAWA, ONT
- ELEVATION- 215 FT ASL
- SUMMER 2 1/2 PERCENT DESIGN AMBIENT TEMP- 875 F DB/74 F WB
- WINTER 2 1/2 PERCENT DESIGN AMBIENT TEMP- 13 F DB

PERFORMANCE DATA

- FLUID COOLED- CLEAN WATER
- TEMPERATURE IN- 150 F
- TEMPERATURE OUT- 85 F
- WATER FLOW- DESIGN- 54,924 LB/HR (110 USGPM)
  NORMAL- 42,971 LB/HR (86 USGPM)
- CALCULATED HEAT EXCHANGE (DESIGN)- 3.56 MILLION BTU/HR.

NOTE- IT IS RECOGNIZED THAT SITE SUMMER ABMIENT TEMPERATURES WILL EXCEED THE TWO ALTERNATIVE AMBIENT DESIGN TEMPERATURES SPECIFIED FOR EQUIPMENT SELECTION. IT IS INTENDED TO COMPARE THE PERFORMANCE OF THE WET AND DRY COOLING TOWERS. ALSO PERFORMANCE DERATING IS EXPECTED DURING THE SUMMER WITH THE DRY SYSTEM.

YOUR EQUIPMENT SELECTION AND BUDGET COST AS WELL AS CATALOGUE DATA WOULD BE APPRECIATED.

G R COOPER

TLX 04-51296
+
PATRICKVAN VCR

APPENDIX II

LAYOUT AND ARRANGEMENT DRAWINGS

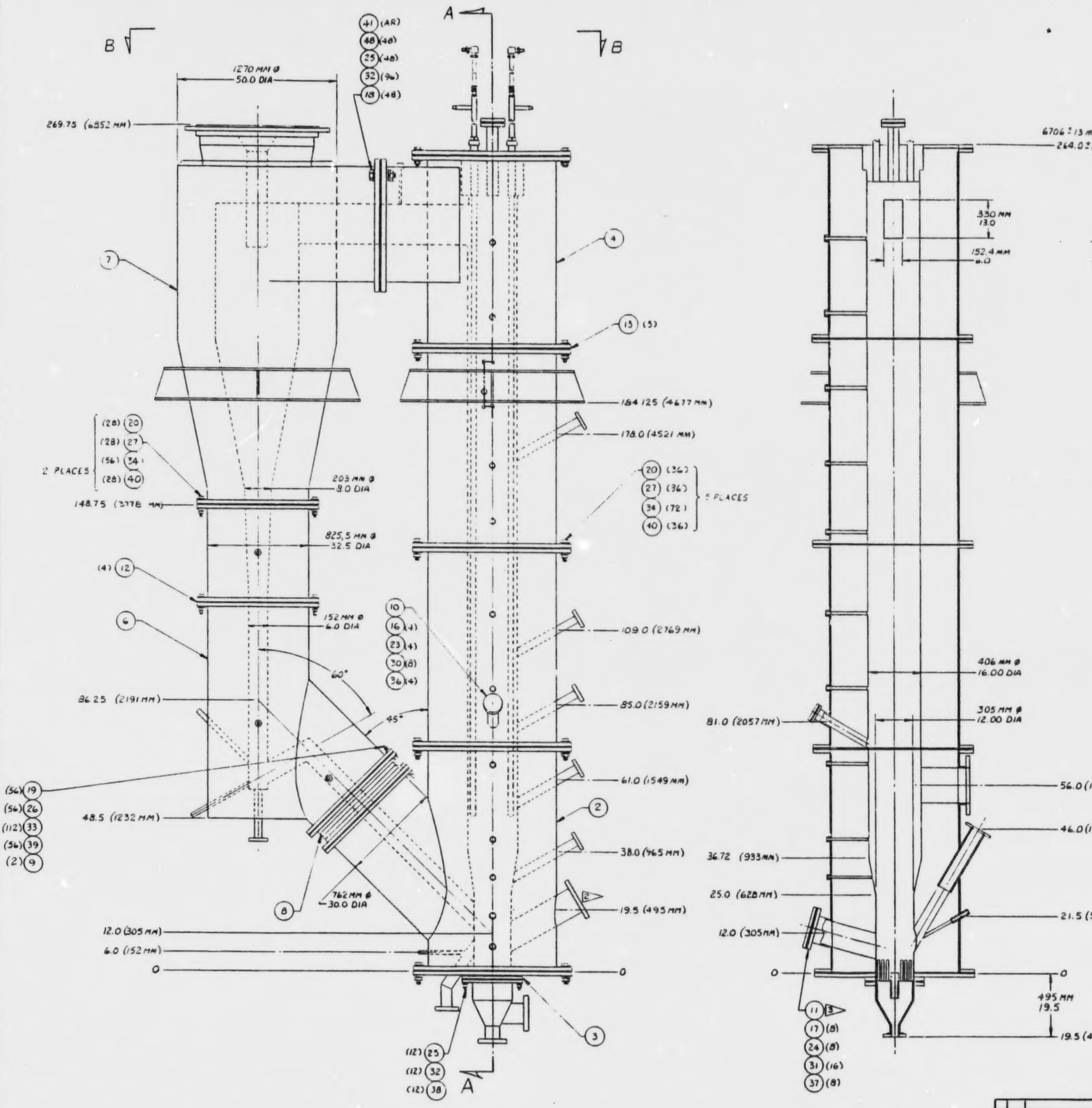
G.A. Technologies

3100 001	Combustor Assembly
3100 002	Combustor Bottom Subassembly
3100 003	Distributor Plate
3100 004	Combustor Top Subassembly
3100 005	Bayonet Tube
3100 006	Combustor L-Valve Subassembly

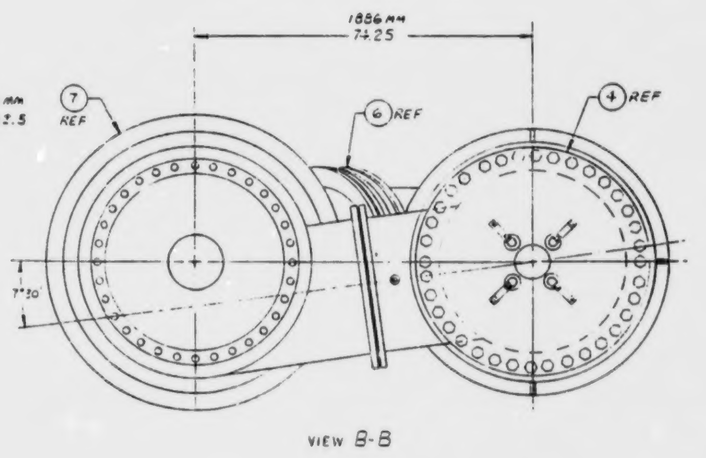
INTEG

AO-0243-4601	Process and Instrumentation Diagram
AO-0243-4701	General Arrangement - Ground Floor and Platform El. 2300
AO-0243-4702	General Arrangement - Platform El. 4700 and 7700
AO-0243-4703	General Arrangement - Section A
AO-0243-4704	General Arrangement - Section B
AO-0243-4705	General Arrangement - Section C and D
AO-0243-4706	General Arrangement - Penthouse and Bayonet Tube Removal System
AO-0243-4707	Revised Layout of Cooling Water System, F.D. Fan, Stack and Blowers

NOTES:
1. ALL DIMENSIONS ON THIS DWG ARE FOR REF ONLY.
2 IGNITER PORT FINAL DIMENSIONS SHALL BE SUPPLIED BY INTES.
3 LOWER NOZZLE ROTATED 45° CW IN SECT A-A.



B
A
B
A
A
(41) (AR)
(48) (48)
(25) (48)
(32) (96)
(18) (48)
1270 MM ø
50.0 DIA
269.75 (6852 MM)
7
4
6
2
3
8
13 (5)
184.125 (4677 MM)
178.0 (4521 MM)
(28) 20
(28) 27
(56) 34
(28) 40
2 PLACES
203 MM ø
8.0 DIA
148.75 (3778 MM)
825.5 MM ø
32.5 DIA
(4) 12
20 (36)
27 (36)
34 (72)
40 (36)
5 PLACES
152 MM ø
6.0 DIA
10
16 (4)
23 (4)
30 (8)
36 (4)
60°
45°
109.0 (2769 MM)
86.25 (2191 MM)
85.0 (2159 MM)
61.0 (1549 MM)
(56) 19
(56) 26
(112) 33
(56) 39
(2) 9
48.5 (1232 MM)
38.0 (965 MM)
762 MM ø
30.0 DIA
19.5 (495 MM)
12.0 (305 MM)
6.0 (152 MM)
0
0
(12) 25
(12) 32
(12) 38
6706 ± 13 MM
264.0 ± .5
330 MM
13.0
152.4 MM
6.0
406 MM ø
16.00 DIA
305 MM ø
12.00 DIA
81.0 (2057 MM)
56.0 (1422 MM)
46.0 (1168 MM)
36.72 (933 MM)
25.0 (628 MM)
21.5 (546 MM)
12.0 (305 MM)
0
0
495 MM
19.5
19.5 (495 M)
11 3
17 (8)
24 (8)
31 (16)
37 (8)



1886 MM
74.25
7 REF
6 REF
4 REF
7°30'

VIEW B-B

	ITEM	PART NO.	DESCRIPTION	MAT'L
AR	41		GRAFOIL	(UNION CARBIDE)
[illegible]	40		WASHER, LOCK 1½	CARBON STEEL
56	39		WASHER, LOCK 1¼	
60	38		WASHER, LOCK ⅞	
8	37		WASHER, LOCK ¾	
4	36		WASHER, LOCK ⅝	
	35			
[illegible]	34		WASHER, PLAIN 1½	
112	33		WASHER, PLAIN 1¼	
108	32		WASHER, PLAIN ⅞	
16	31		WASHER, PLAIN ¾	
8	30		WASHER, PLAIN ⅝	
	29			
	28			
[illegible]	27		NUT-HEX, 1½	
56	26		NUT-HEX, 1¼	
60	25		NUT-HEX, ⅞	
8	24		NUT-HEX, ¾	
4	23		NUT-HEX, ⅝	
	22			
	21			
[illegible]	20		BOLT-HEX HEAVY 1½-6 UNC 2A 5½ LG	
56	19		BOLT-HEX HEAVY 1¼-7 UNC 2A 5½ LG	
48	18		BOLT-HEX HD ⅞-9 UNC 2A 5 LG	
8	17		BOLT-HEX HD ¾-10 UNC 2A 4 LG	
4	16		BOLT-HEX HD ⅝-11 UNC 2A 3¾ LG	CARBON STEEL
48	15			
	14			
5	13		GASKET FLEXITALLIC CG LINE	40" 150 ANSI SS 304
4	12		GASKET FLEXITALLIC CG LINE	32" 150 ANSI SS 304
1	11		GASKET FLEXITALLIC CG LINE	8 150 ANSI SS 304
1	10		GASKET FLEXITALLIC CG LINE	3 150 ANSI SS 304
2	9		GASKET FLEXITALLIC CG LINE	30" 150 ANSI SS 304
1	8		BELLOWS	
1	7	C-24254	CYCLONE COLLECTOR	(DUCON-MIKROPUL LIMITED)
1	6	3100006	COMBUSTOR L VALVE SUB ASSY	
	5			
1	4	3100004	COMBUSTOR TOP SUB ASSY	
1	3	3100003	DISTRIBUTOR PLATE	
1	2	3100002	COMBUSTOR BOTTOM SUB ASSY	
	1		ASSY	
-1				

LIST OF MATERIAL

LTR	DATE	ISSUE DESCRIPTION	DR	CHK	DES	APPD	APPD
		FOR INFORMATION					

INFO

CANMET
COMBUSTOR ASSY

GENERAL ATOMIC COMPANY

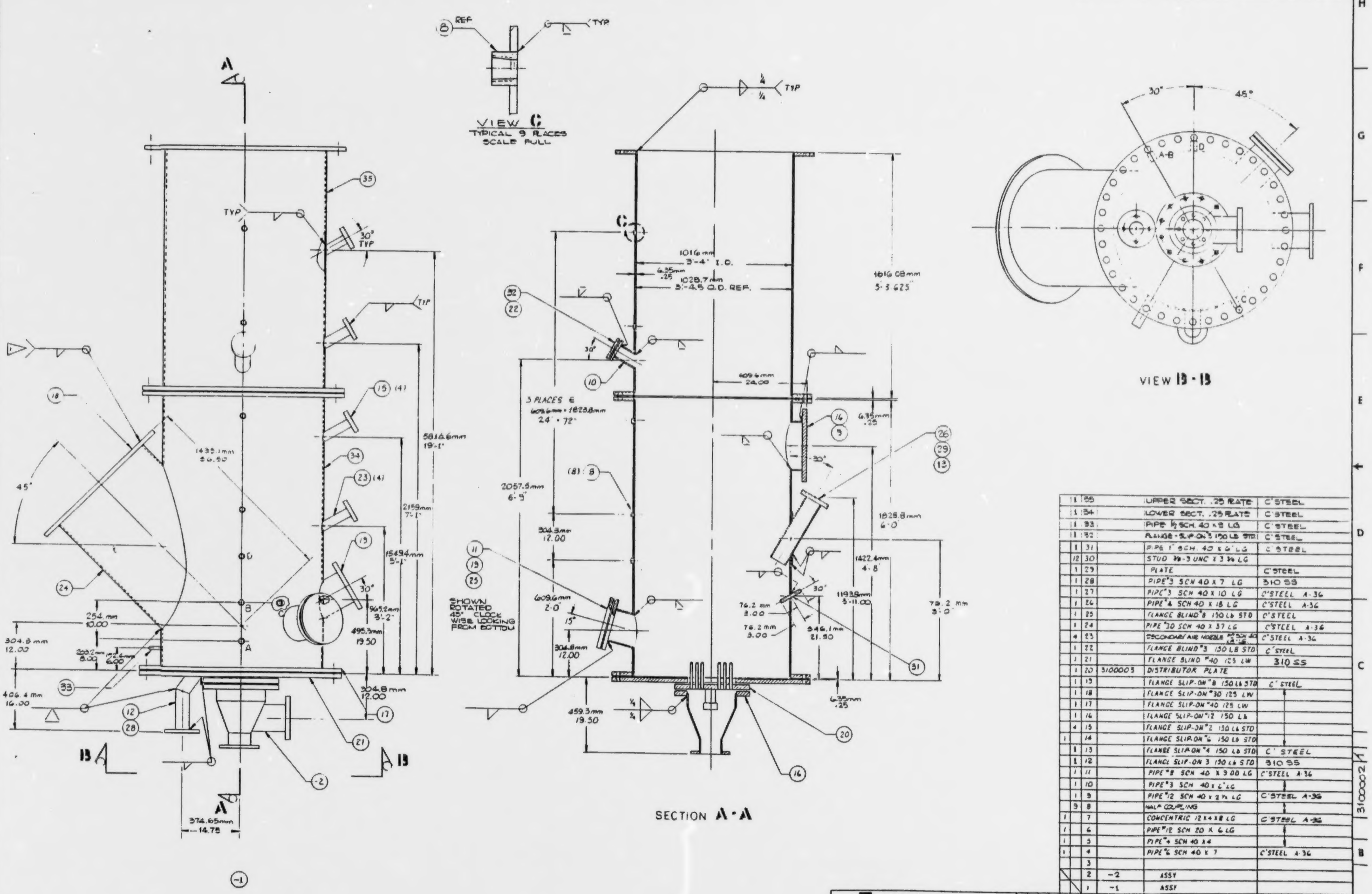
3100001

3100001

3100001

3100002 1 of 2

NOTES: UNLESS OTHERWISE SPECIFIED.
1▷ LEAVE FLANGE LOOSE TO MEET BELLOWS FLANGE BOLT HOLE CIRCLE.
2▷ SHAPE ITEM 23 CYLINDRICAL TO MEET WITH CYLINDER


A
VIEW C
TYPICAL 9 PLACES
SCALE FULL
REF
TYP
35
30° TYP
1435.1mm
56.50
5816.6mm
19'-1"
2159mm
7'-1"
1549.4mm
5'-1"
965.2mm
3'-2"
495.3mm
19.50
304.8mm
12.00
254mm
10.00
203.2mm
8.00
152.4mm
6.00
406.4mm
16.00
45°
15 (4)
23 (4)
34
19
24
18
33
12
28
21
17
-2
B
B
A
374.65mm
14.75
-1
1016mm
3'-4" I.D.
6.35mm
.25
1028.7mm
3'-4.5 O.D. REF.
1616.08mm
5'-3.625"
3 PLACES E
609.6mm - 1828.8mm
24 - 72"
609.6mm
24.00
6.35mm
.25
2057.8mm
6'-9"
304.8mm
12.00
609.6mm
2'-0"
15°
306.8mm
12.00
1828.8mm
6'-0"
1422.4mm
4'-8"
1193.8mm
3'-11.00
76.2mm
3'-0"
76.2mm
3.00
546.1mm
21.50
459.3mm
19.50
SHOWN ROTATED 45° CLOCKWISE LOOKING FROM BOTTOM
32
22
10
(8) 8
11
19
25
16
9
26
29
13
30°
31
20
16
SECTION A-A
30°
45°
A-B
D
C
VIEW B-B

-2	1	ITEM	PART NO	DESCRIPTION	MATL
	1	35		UPPER SECT. .25 PLATE	C'STEEL
	1	34		LOWER SECT. .25 PLATE	C'STEEL
	1	33		PIPE ½ SCH. 40 x 3 LG	C'STEEL
	1	32		FLANGE-SLIP-ON ½ 150 LB STD	C'STEEL
	1	31		PIPE 1" SCH. 40 x 6" LG	C'STEEL
	12	30		STUD ⅜-3 UNC x 3 ⅜ LG	
	1	29		PLATE	C'STEEL
	1	28		PIPE "3 SCH 40 x 7 LG	310 SS
	1	27		PIPE "3 SCH 40 x 10 LG	C'STEEL A-36
	1	26		PIPE "4 SCH 40 x 18 LG	C'STEEL A-36
	1	25		FLANGE BLIND "8 150 LB STD	C'STEEL
	1	24		PIPE "30 SCH 40 x 37 LG	C'STEEL A-36
	4	23		SECONDARY AIR NOZZLE [illegible] SCH 40 LG	C'STEEL A-36
	1	22		FLANGE BLIND "3 150 LB STD	C'STEEL
	1	21		FLANGE BLIND "40 125 LW	310 SS
	1	20	3100003	DISTRIBUTOR PLATE	
	1	19		FLANGE SLIP-ON "8 150 LB STD	C'STEEL
	1	18		FLANGE SLIP-ON "30 125 LW	
	1	17		FLANGE SLIP-ON "40 125 LW	
	1	16		FLANGE SLIP-ON "12 150 LB	
	4	15		FLANGE SLIP-ON "2 150 LB STD	
1		14		FLANGE SLIP-ON "6 150 LB STD	
	1	13		FLANGE SLIP-ON "4 150 LB STD	C' STEEL
	1	12		FLANGE SLIP-ON 3 150 LB STD	310 SS
	1	11		PIPE "8 SCH 40 x 9.00 LG	C'STEEL A-36
	1	10		PIPE "3 SCH 40 x 6" LG	
	1	9		PIPE "12 SCH 40 x 2 ½ LG	C'STEEL A-36
	9	8		HALF COUPLING	
1		7		CONCENTRIC 12 x 4 x 8 LG	C'STEEL A-36
1		6		PIPE "12 SCH 20 x 6 LG	
1		5		PIPE "4 SCH 40 x 4	
1		4		PIPE "6 SCH 40 x 7	C'STEEL A-36
		3			
		2	-2	ASSY	
		1	-1	ASSY	

REQD/ASSEMBLY

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO, CALIFORNIA

LTR	DATE	DESCRIPTION	DR	CHK	DES	APPD	APPD
INFO 1		FOR INFORMATION ONLY	J.O.				LIP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS X.XX ± .03
FRACTIONS ± 1/16
ANGLES ± 1°
ALL MACHINED SURFACES

SCALE 1/8

CANMET ARFBC PILOT PLANT

COMBUSTER BOTTOM SUB ASSY

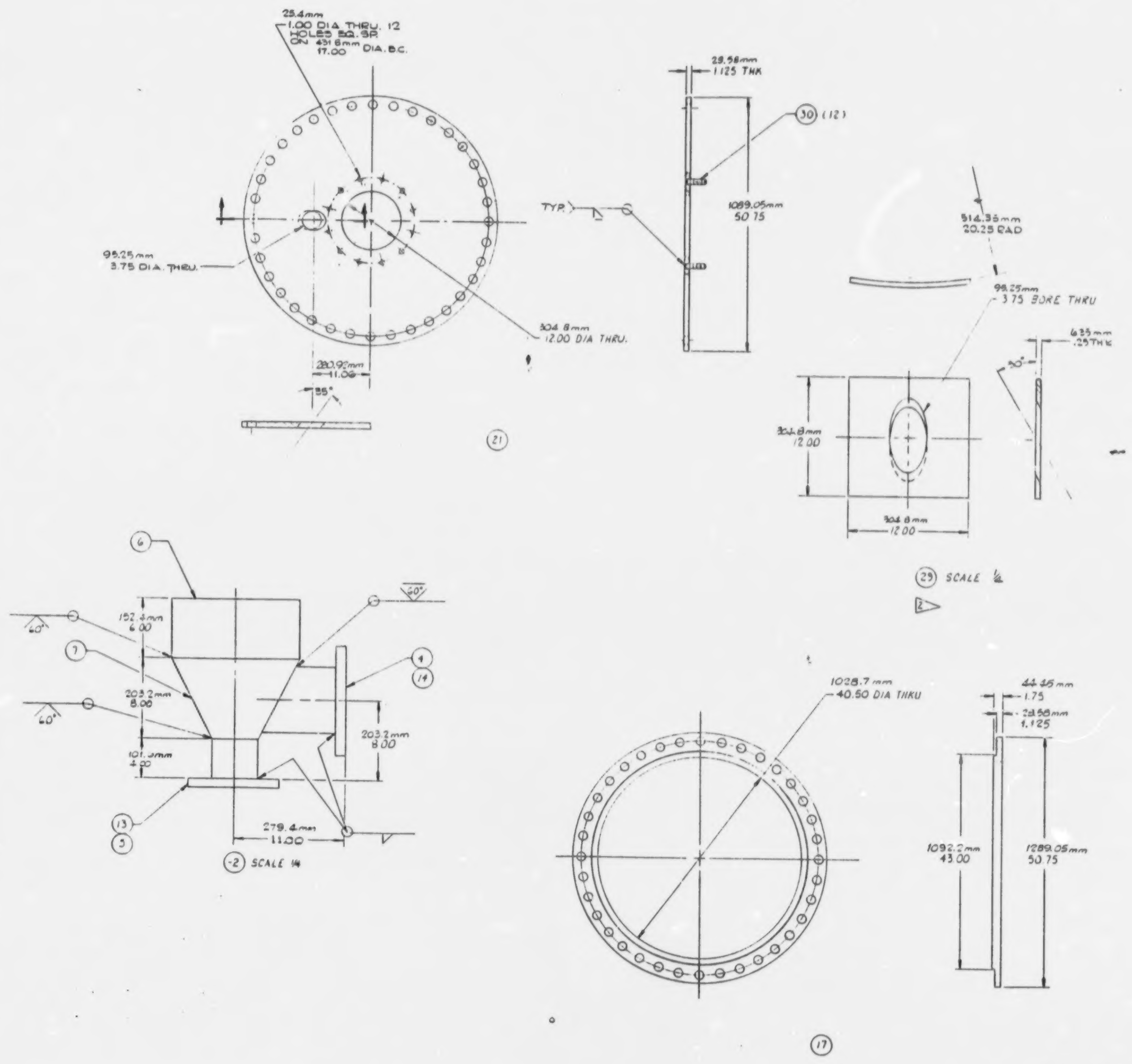
GENERAL ATOMIC COMPANY
SAN DIEGO, CALIFORNIA

DRAWING NUMBER 3100002
REV 1

SHT 1 OF 2

3100002 A

3100002
Sheet 2 of 2


25.4mm
1.00 DIA THRU. 12 HOLES SQ. SP. ON 431.8mm 17.00 DIA. B.C.
95.25mm
3.75 DIA. THRU.
304.8mm
12.00 DIA THRU.
280.92mm
11.06
35°
(21)
28.58mm
1.125 THK
(30) (12)
TYP.
1089.05mm
50.75
514.35mm
20.25 RAD
95.25mm
3.75 BORE THRU
6.35mm
.25 THK
30°
304.8mm
12.00
304.8mm
12.00
(29) SCALE 1/4
2
(6)
(7)
152.4mm
6.00
203.2mm
8.00
101.6mm
4.00
60°
60°
60°
(4)
(14)
203.2mm
8.00
(13)
(5)
279.4mm
11.00
(-2) SCALE 1/4
1028.7mm
40.50 DIA THRU
44.45mm
1.75
28.58mm
1.125
1092.2mm
43.00
1289.05mm
50.75
(17)

GA Technologies Inc.
SAN DIEGO CALIFORNIA

LTR	DATE	REVISION DESCRIPTION	DR	CHK	DES	APPD	APPD

ITEM | PART NO | DESCRIPTION | MATL
LIST OF MATERIAL

CANMET ARFBC PILOT PLANT

COMBUSTER BOTTOM
SUB ASSY

~~GENERAL ATOMIC COMPANY~~
~~SAN DIEGO CALIFORNIA~~

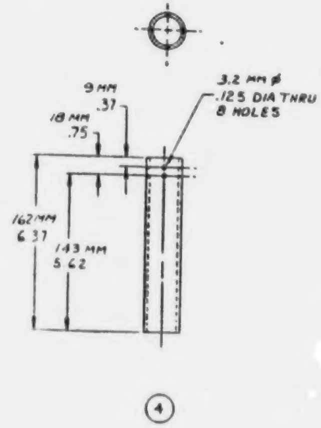
DRAWING NUMBER 3100002
1/1

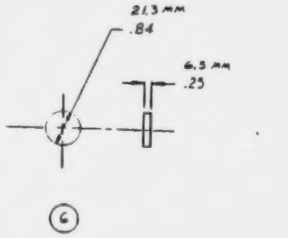
SCALE 1/4

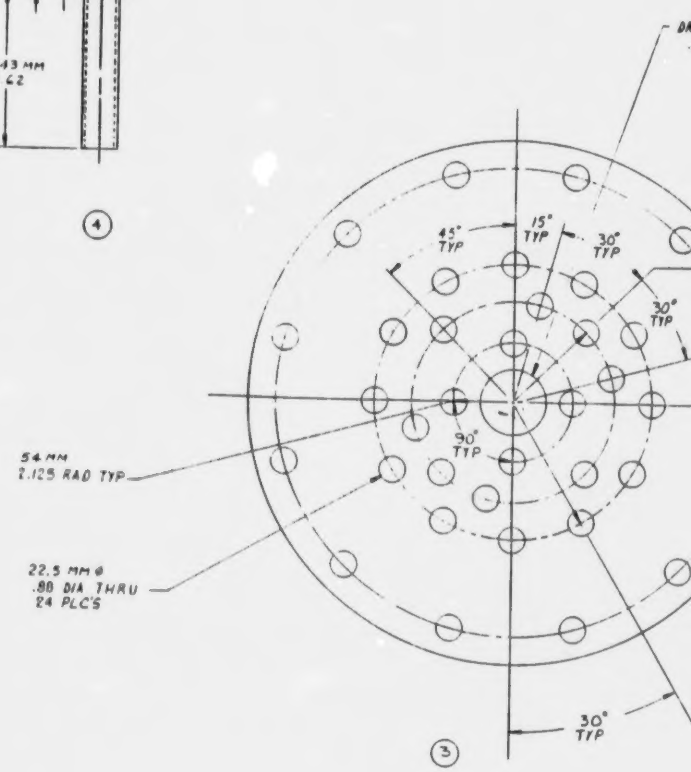
SHT 2 OF 2

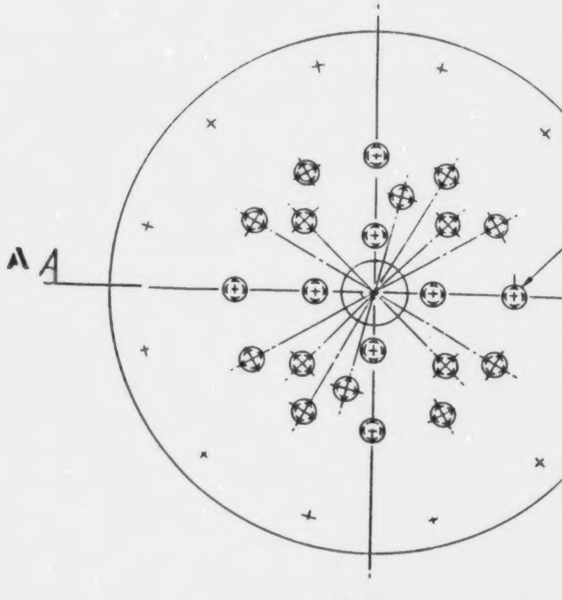
3100002 1/1

3100003

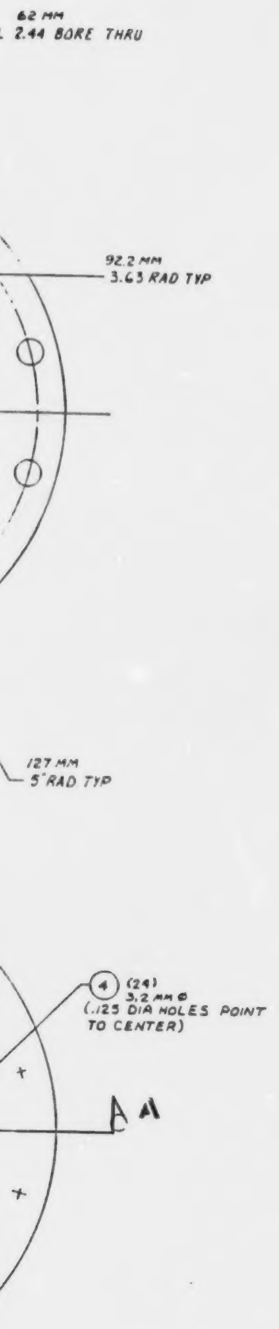

9 MM
.37
18 MM
.75
3.2 MM ⌀
.125 DIA THRU
8 HOLES
162 MM
6.37
143 MM
5.62
④

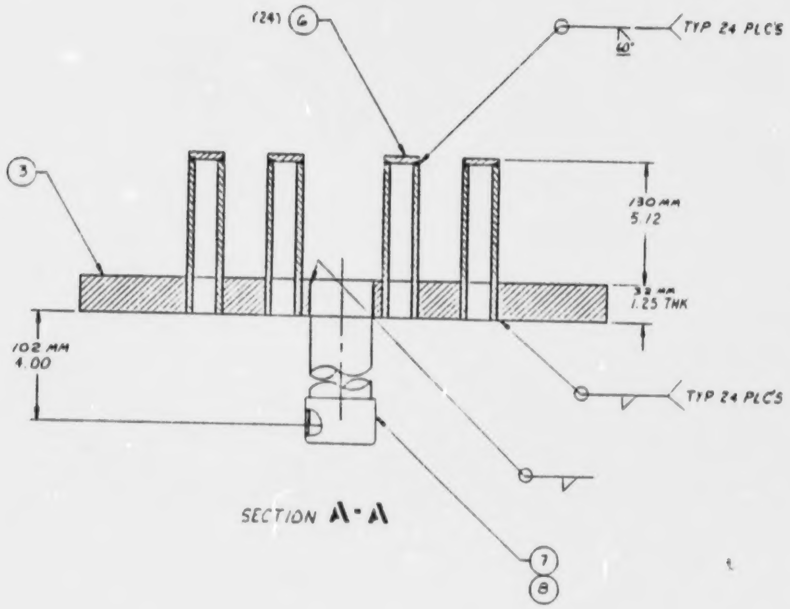

21.3 MM
.84
6.5 MM
.25
⑥


DR
45° TYP
15° TYP
30° TYP
30° TYP
90° TYP
54 MM
2.125 RAD TYP
22.5 MM ⌀
.88 DIA THRU
24 PLC'S
30° TYP
③


A
A
-1 ASSY

NOTES:
1. GRIND ALL WELDS
2. PENETRANT INSPECT WELDS - PT-3801
3. ALL WELDS PER DI-TI


62 MM
2.44 BORE THRU
92.2 MM
3.63 RAD TYP
127 MM
5" RAD TYP
4 (24) 3.2 MM ⌀
(.125 DIA HOLES POINT TO CENTER)
A A


(24) 6
TYP 24 PLC'S
60°
3
130 MM
5.12
32 MM
1.25 THK
102 MM
4.00
TYP 24 PLC'S
7
8

SECTION A-A

REQD/ASSEMBLY -1	ITEM	PART NO	DESCRIPTION	MATL
1	8	32815	CAP, PIPE, 150#	(LADISH ST STL)
1	7		PIPE 2 SCH 40 X $\frac{102\text{ MM}}{4.00}$ LG	ASTM A-312 TYPE 316SS
24	6		BAR 1" DIA (25 MM)	ASTM A-276 TYPE 316SS
	5			
24	4		PIPE ½" SCH 40 X $\frac{162\text{ MM}}{6.37}$ LG	ASTM A-312 TYPE 316 SS
1	3		FLANGE BLIND® 12" 150 LB STD	ASTM A-312 TYPE 316 SS
	2			
	1		ASSY	

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO, CALIFORNIA

LTR	DATE	ISSUE DESCRIPTION	DR	CHK	DES	APPD	APPD
1		FOR INFO ONLY	J.O.				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS .XXX±.010 .XX±.03 FRACTIONS ± 1/64 ANGLES ± 1° ALL MACHINED SURFACES

CANMET ARFBC PILOT PLANT

DISTRIBUTOR PLATE

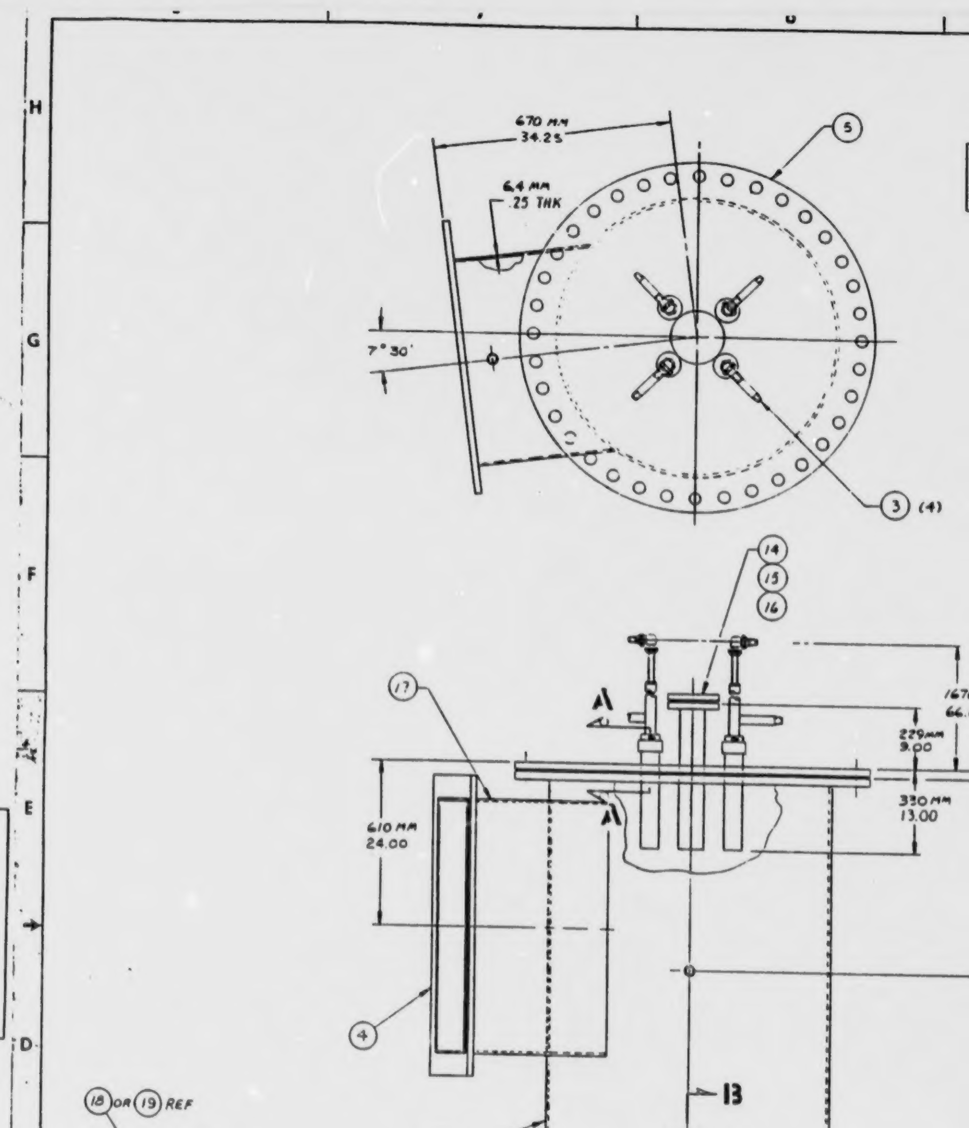
GENERAL ATOMIC COMPANY
SAN DIEGO, CALIFORNIA

SCALE NONE

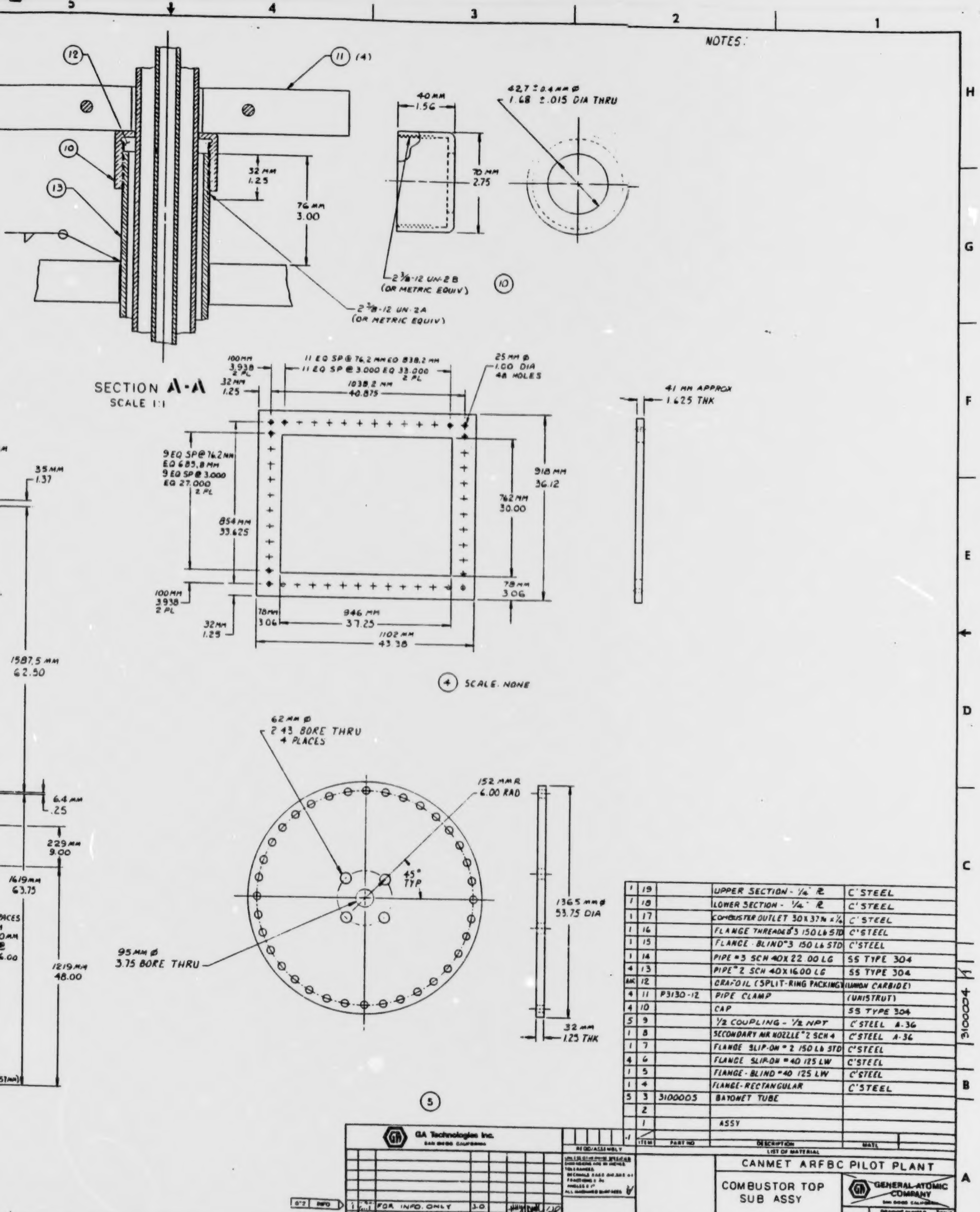
DRAWING NUMBER 3100003 ISSUE 1

WAS 5244151

31000004



H
G
F
E
D
C
B
A
8
7
6
670 MM
34.25
6.4 MM
.25 THK
7° 30'
5
3
(4)
14
15
16
17
A
A
229 MM
9.00
330 MM
13.00
610 MM
24.00
4
13
13
19
18 OR 19 REF
9 REF
SECTION 13-13
TYP 5 PLACES
SCALE: 1/1
152 MM
6.00
229 MM
9.00
152 MM
6.00
13 MM
.50
13 MM
.50
30°
60°
7
8
4 EQ
@ 610
EQ 2
4 EQ S
24.00
968 MM
38.12
(5) 5
18
TYP
1/4
1/4
(4) 6
1016 MM ø
40.00 DIA
-1
6.4 MM
.25
2.2



NOTES:
(12)
(11) (4)
(10)
(13)
32 MM
1.25
76 MM
3.00
2 7/8-12 UN-2A
(OR METRIC EQUIV)
SECTION A-A
SCALE 1:1
40 MM
1.56
70 MM
2.75
2 7/8-12 UN-2B
(OR METRIC EQUIV)
(10)
42.7 ± 0.4 MM ⌀
1.68 ±.015 DIA THRU
100MM
3.938
2 PL
32MM
1.25
11 EQ SP @ 76.2 MM EQ 838.2 MM
11 EQ SP @ 3.000 EQ 33.000
2 PL
1038.2 MM
40.875
25 MM ⌀
1.00 DIA
48 HOLES
41 MM APPROX
1.625 THK
9 EQ SP @ 76.2 MM
EQ 685.8 MM
9 EQ SP @ 3.000
EQ 27.000
2 PL
854 MM
33.625
918 MM
36.12
762 MM
30.00
35 MM
1.37
100MM
3.938
2 PL
78MM
3.06
78 MM
3.06
32MM
1.25
946 MM
37.25
1102 MM
43.38
1587.5 MM
62.50
(4) SCALE: NONE
62 MM ⌀
2.43 BORE THRU
4 PLACES
152 MM R
6.00 RAD
45°
TYP
6.4 MM
.25
229 MM
9.00
1619 MM
63.75
1219 MM
48.00
95 MM ⌀
3.75 BORE THRU
1365 MM ⌀
53.75 DIA
32 MM
1.25 THK
(5)
5
4
3
2
1
H
G
F
E
D
C
B
A

	ITEM	PART NO	DESCRIPTION	MAT'L
1	19		UPPER SECTION - 1/4" R	C' STEEL
1	18		LOWER SECTION - 1/4" R	C' STEEL
1	17		COMBUSTER OUTLET 30 X 37 3/4 x 1/4	C' STEEL
1	16		FLANGE THREADED #3 150 LB STD	C' STEEL
1	15		FLANGE - BLIND #3 150 LB STD	C' STEEL
1	14		PIPE #3 SCH 40 X 22.00 LG	SS TYPE 304
4	13		PIPE #2 SCH 40 X 16.00 LG	SS TYPE 304
AR	12		GRAFOIL (SPLIT-RING PACKING)	(UNION CARBIDE)
4	11	P3130-12	PIPE CLAMP	(UNISTRUT)
4	10		CAP	SS TYPE 304
5	9		1/2 COUPLING - 1/2 NPT	C' STEEL A-36
1	8		SECONDARY AIR NOZZLE #2 SCH 4	C' STEEL A-36
1	7		FLANGE SLIP-ON #2 150 LB STD	C' STEEL
4	6		FLANGE SLIP-ON #40 125 LW	C' STEEL
1	5		FLANGE - BLIND #40 125 LW	C' STEEL
1	4		FLANGE - RECTANGULAR	C' STEEL
5	3	3100005	BAYONET TUBE	
	2			
	1		ASSY	

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO CALIFORNIA

LTR	DATE	ISSUE DESCRIPTION	DR	CHK	DES	APPD	APPD
1		FOR INFO. ONLY	J.O.				

REQD/ASSEMBLY

CANMET ARFBC PILOT PLANT

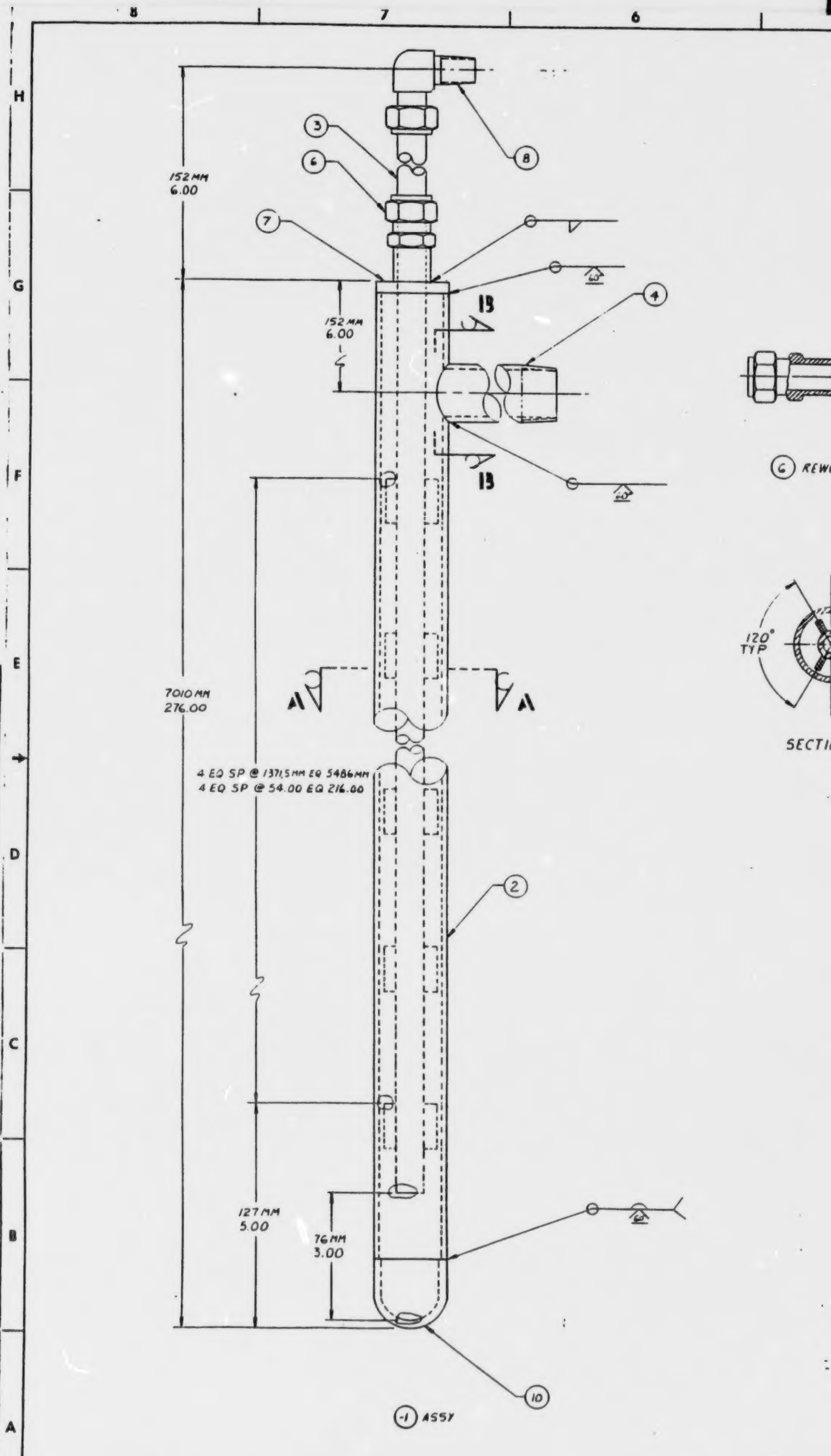
COMBUSTOR TOP
SUB ASSY

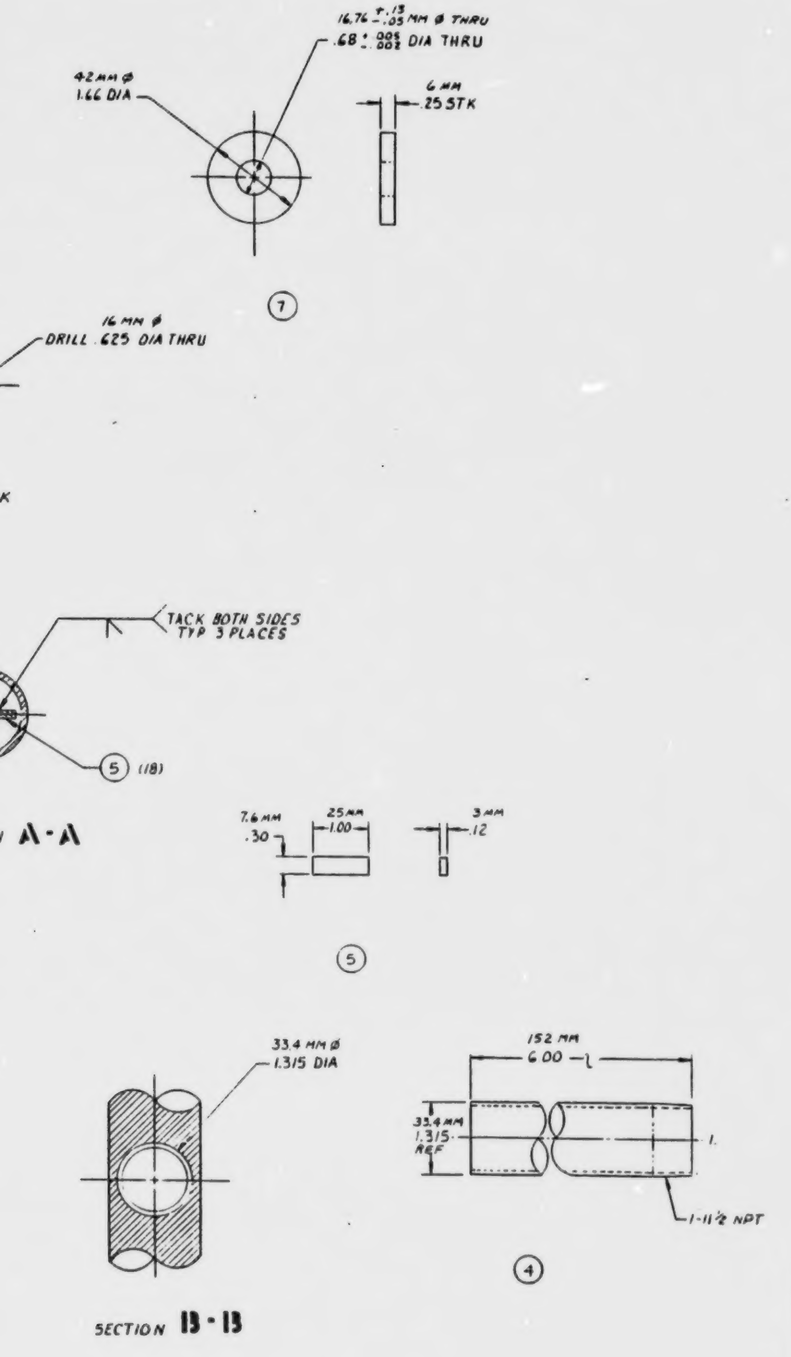
GENERAL ATOMIC COMPANY
SAN DIEGO CALIFORNIA

SCALE
DRAWING NUMBER 3100004
ISSUE 1

3100004 1

3100005


8
7
6
H
G
F
E
D
C
B
A
152 MM
6.00
3
6
7
8
4
13
13
152 MM
6.00
7010 MM
276.00
A
A
4 EQ SP @ 1371,5 MM EQ 5486 MM
4 EQ SP @ 54.00 EQ 216.00
2
127 MM
5.00
76 MM
3.00
10
-1 ASSY
60
6 REW
120° TYP
SECTI


16.76 +.13 −.05 MM ⌀ THRU
.68 +.005 −.002 DIA THRU
42 MM ⌀
1.66 DIA
6 MM
.25 STK
7
16 MM ⌀
DRILL .625 DIA THRU
K
TACK BOTH SIDES
TYP 3 PLACES
5 (18)
A-A
7.6 MM
.30
25 MM
1.00
3 MM
.12
5
33.4 MM ⌀
1.315 DIA
152 MM
6.00
33.4 MM
1.315
REF
1-11½ NPT
4
SECTION B-B

NOTES:
1 GRIND ALL WELDS
2 PENETRANT INSPECT WELDS-PT-3801
3 ALL WELDS PER DI-TI

REQD/ASSEMBLY	ITEM	PART NO.	DESCRIPTION	MATL
	19			
	18			
	17			
	16			
	15			
	14			
	13			
	12			
	11			
1	10	49	CAP 1¼" SHC 80	(LADISH)
	9			
1	8	SS1010-2-8	UNION ELBOW	316 SS (SWAGELOK)
1	7		CAP 1.66 DIA X ¼ THK	ASTM-312 TYPE 304SS
1	6	1010-1-8MPW	PIPE WELD CONNECTOR	316 SS (SWAGELOCK)
18	5		SPACER	ASTM.312 TYPE 304SS
1	4		PIPE 1" SCH 40 X 6"	ASTM-312 TYPE 304SS
1	3		TUBING 5/8 O.D BWG 18 X23½	ASTM-312 TYPE 304SS
1	2		PIPE, 1¼ SCH. 40 X 2 3'	ASTM A-312 TYPE 304SS
	1		ASSY	
-1				

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO CALIFORNIA

LTR	DATE	ISSUE DESCRIPTION	DR	CHK	DES	APPD	APPD
1		FOR INFO. ONLY	J.O				

CANMET ARFBC PILOT PLANT

BAYONET TUBE

GENERAL ATOMIC COMPANY
SAN DIEGO CALIFORNIA

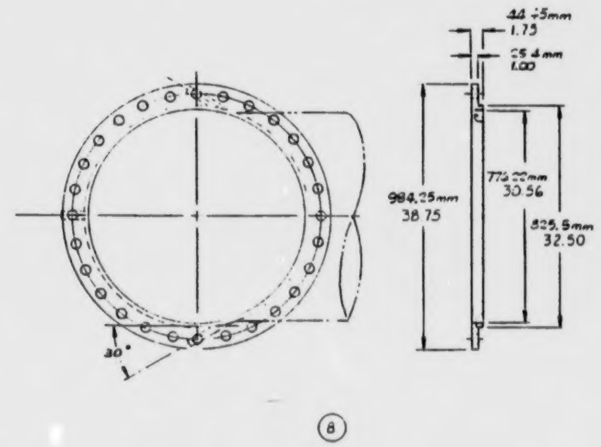
SCALE FULL

DRAWING NUMBER 3100005 ISSUE 1

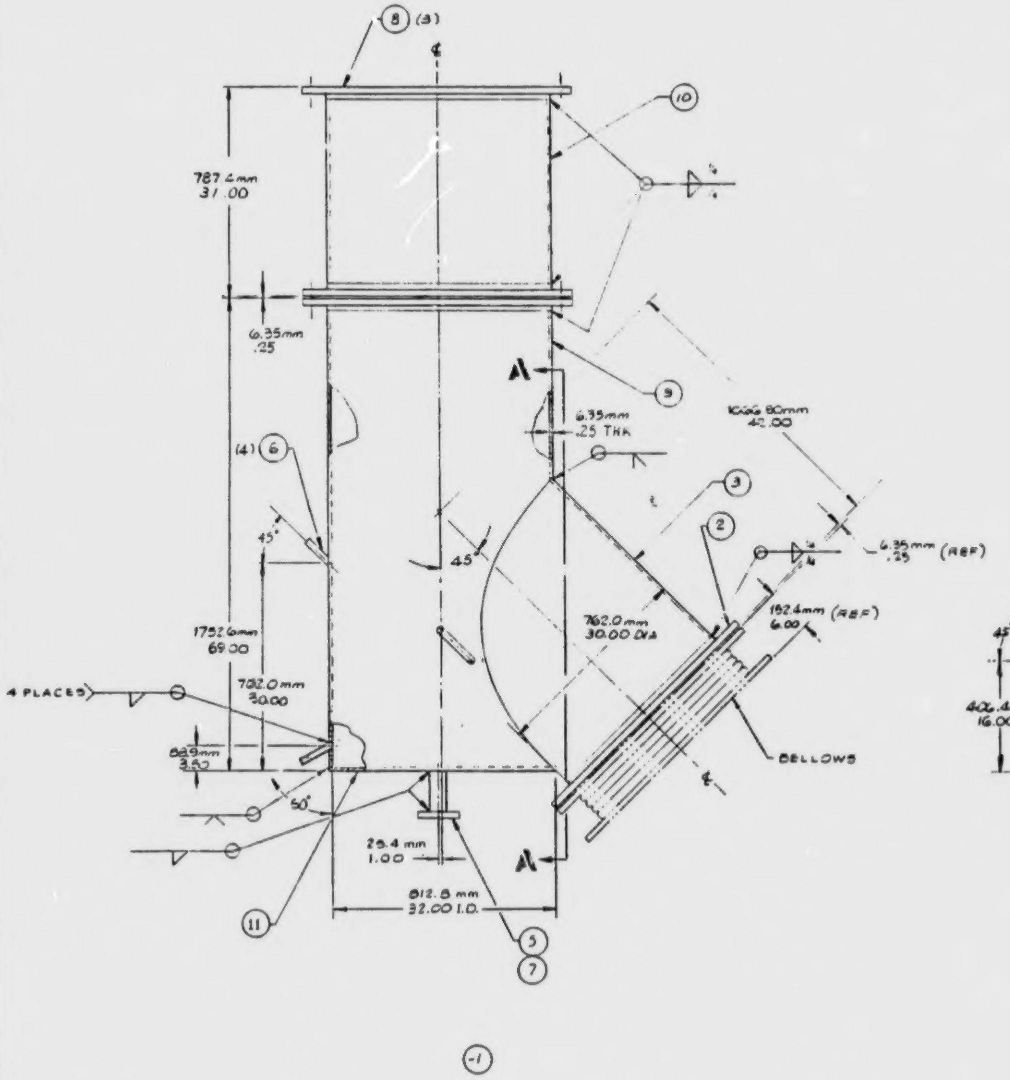
WAS 5244152

3100005 1

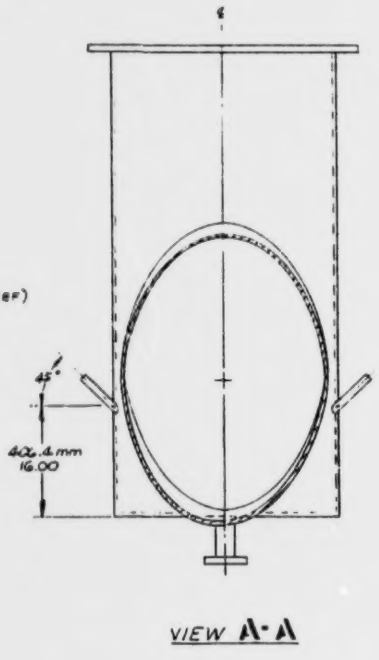
3100006



44.45mm
1.75
25.4mm
1.00
984.25mm
38.75
776.22mm
30.56
825.5mm
32.50
30°
⑧



⑧ (3)
℄
⑩
787.4mm
31.00
6.35mm
.25
A
⑨
6.35mm
.25 THK
1066.80mm
42.00
(4) ⑥
45°
③
②
6.35mm
.25 (REF)
45°
762.0mm
30.00 DIA
152.4mm (REF)
6.00
1752.6mm
69.00
4 PLACES
762.0mm
30.00
88.9mm
3.50
BELLOWS
℄
50°
25.4mm
1.00
A
812.8mm
32.00 I.D.
⑪
⑤
⑦
-1



℄
45°
406.4mm
16.00

VIEW A-A

1	11		PLATE 1/4"	C'STEEL
1	10		CYLINDER	C'STEEL
1	9		CYLINDER	
3	8		FLANGE "32" SLIP-ON 125 LW	
1	7		FLANGE "2" SLIP-ON 150 LB STD	
4	6		PIPE 1" SCH 40 X 6.00 LG	
1	5		PIPE "2" SCH 40 X 6.00 LG	C'STEEL
3	4		PIPE "1/2" SCH 40	C'STEEL A-36
1	3		CYLINDER	C'STEEL
1	2		FLANGE "30" SLIP-ON 125 LW	C'STEEL
	1		ASSY	
-1				
REQD/ASSEMBLY	ITEM	PART NO.	DESCRIPTION	MATL

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO CALIFORNIA

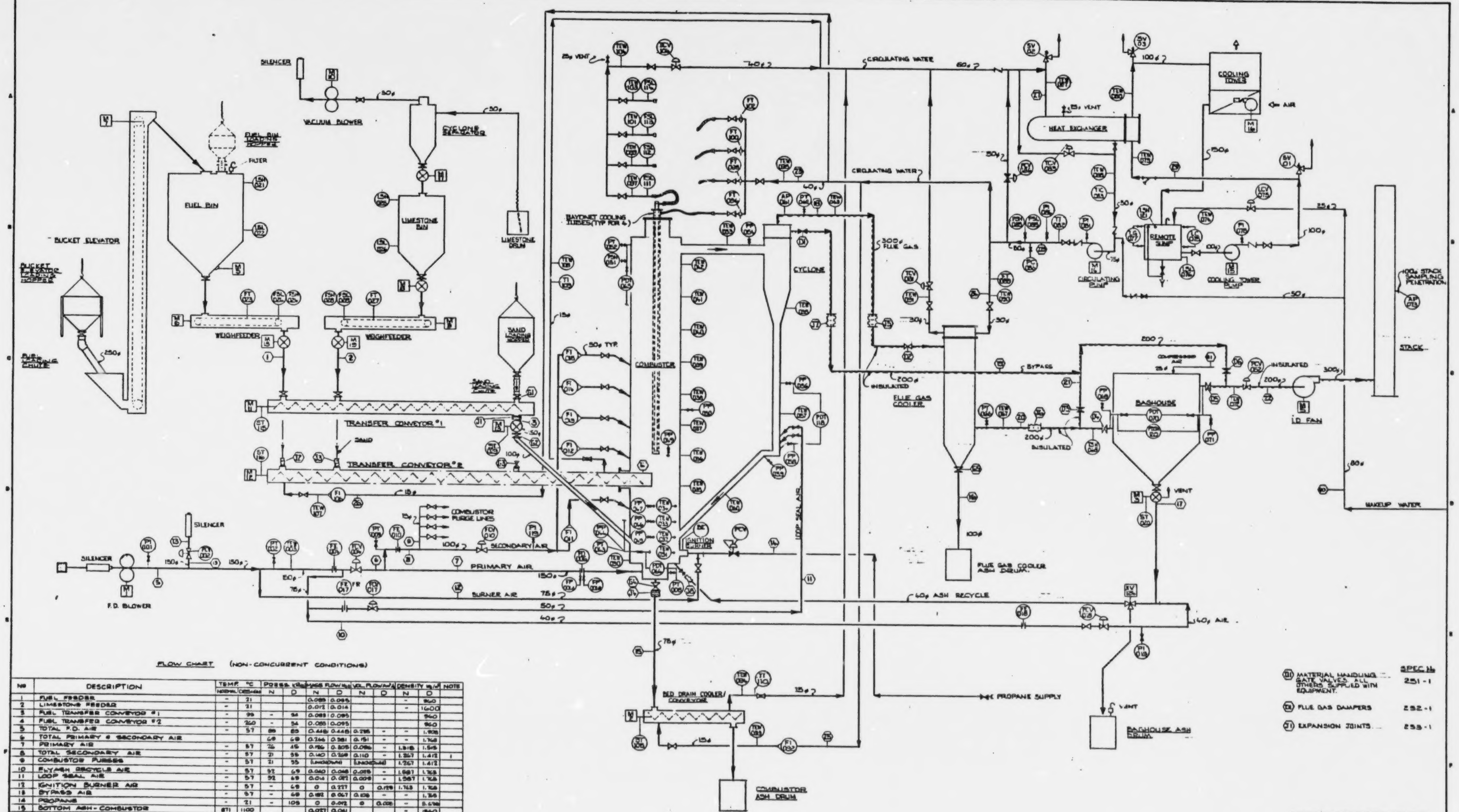
LTR	DATE	ECN DESCRIPTION	DR	CHK	DES	APPD	APPD
1		FOR INFO ONLY	3.0				

CANMET ARFBC PILOT PLANT

COMBUSTOR
L VALVE
SUB ASSY

GENERAL ATOMIC COMPANY
SAN DIEGO, CALIFORNIA

DRAWING NUMBER 3100006
REV 1


SILENCER
VACUUM BLOWER
CYCLONE SEPARATOR
FUEL BIN LOADING HOPPER
FILTER
FUEL BIN
LIMESTONE BIN
LIMESTONE DRUM
BUCKET ELEVATOR
BUCKET ELEVATOR FEED HOPPER
AIR SLIDING CHUTE
WEIGHFEEDER
SAND LOADING HOPPER
SAND LOADING CHUTE
TRANSFER CONVEYOR #1
TRANSFER CONVEYOR #2
SAND
COMBUSTOR PURGE LINES
SECONDARY AIR
PRIMARY AIR
BURNER AIR
F.D. BLOWER
BAYONET COOLING TUBES (TYP FOR 4)
COMBUSTOR
CYCLONE
IGNITION BURNER
LOOP SEAL AIR
300φ FLUE GAS
CIRCULATING WATER
HEAT EXCHANGER
COOLING TOWER
AIR
REMOTE SUMP
CIRCULATING PUMP
COOLING TOWER PUMP
100φ STACK SAMPLING PENETRATION
STACK
FLUE GAS COOLER
INSULATED
BYPASS
COMPRESSED AIR
BAGHOUSE
I.D. FAN
FLUE GAS COOLER ASH DRUM
60φ ASH RECYCLE
PROPANE SUPPLY
BED DRAIN COOLER/CONVEYOR
COMBUSTOR ASH DRUM
BAGHOUSE ASH DRUM
VENT
MAKEUP WATER

FLOW CHART (NON-CONCURRENT CONDITIONS)

NO	DESCRIPTION	TEMP. °C NORMAL	TEMP. °C DESIGN	PRESS. kPa N	PRESS. kPa D	MASS FLOW kg/s N	MASS FLOW kg/s D	VOL. FLOW m³/s N	VOL. FLOW m³/s D	DENSITY kg/m³ N	DENSITY kg/m³ D	NOTE
1	FUEL FEEDER	-	21			0.089	0.095			-	960	
2	LIMESTONE FEEDER	-	21			0.012	0.014			-	1600	
3	FUEL TRANSFER CONVEYOR #1	-	99	-	34	0.088	0.095				960	
4	FUEL TRANSFER CONVEYOR #2	-	260	-	34	0.088	0.095				960	
5	TOTAL F.D. AIR	-	57	89	89	0.448	0.448	0.236	-	-	1.908	
6	TOTAL PRIMARY & SECONDARY AIR			69	69	0.266	0.381	0.151	-	-	1.768	
7	PRIMARY AIR	-	57	26	45	0.126	0.305	0.096	-	1.318	1.545	
8	TOTAL SECONDARY AIR	-	57	21	35	0.140	0.269	0.110	-	1.267	1.412	1
9	COMBUSTOR PURGES	-	57	21	35	(UNKNOWN)		(UNKNOWN)		1.267	1.412	
10	FLYASH RECYCLE AIR	-	57	52	69	0.040	0.048	0.025	-	1.587	1.768	
11	LOOP SEAL AIR	-	57	52	69	0.014	0.072	0.009	-	1.587	1.768	
12	IGNITION BURNER AIR	-	57	-	69	0	0.227	0	0.129	1.768	1.768	
13	BYPASS AIR	-	57	-	69	0.182	0.067	0.108	-	-	1.768	
14	PROPANE	-	21	-	105	0	0.012	0	0.002	-	5.696	
15	BOTTOM ASH - COMBUSTOR	871	1100			0.027	0.041			-	1840	
16	FLYASH - FLUEGAS COOLER	177	260			(UNKNOWN)				-	592	1
17	FLYASH - BAGHOUSE	177	260			0.007	0.020			-	592	
18	FLUEGAS - HOT & DIRTY	898	1100	0	0	0.311	0.506	0.986	1.875	0.326	0.269	
19	FLUEGAS - COOLER BYPASS	100	177	0	0	0	0.311	0	0.380	-	0.818	
20	FLUEGAS - COOL & DIRTY	177	260	-1	-2	0.311	0.506	0.380	0.760	0.818	0.666	
21	FLUEGAS - BAGHOUSE BYPASS	177	260	-1	-2	0	0.311	0	0.456	0.818	0.666	
22	FLUEGAS - COOL & CLEAN	177	260	-4	-5	0.506	0.474	0.380	0.696	0.818	0.666	
23	COOLING WATER - BAYONET TUBES	-	29	-	370	-	8.612	-	516	-	996	2
24	COOLING WATER - FLUEGAS COOLER	-	29	-	470	-	2.580	-	156	-	996	2
25	COOLING WATER - BED DRAIN COOLER	-	29	-	580	-	0.340	-	20	-	996	2
26	COOLING WATER - FUEL CONVEYOR #2	-	29	-	580	-	0.377	-	23	-	996	2
27	COOLING WATER RETURN	-	66	-	108	-	6.818	-	424	-	980	2
28	COOLING WATER SUPPLY	-	29	-	612	-	6.818	-	417	-	996	2
29	COOLING TOWER WATER	-	26	-	176	-	20.106	-	1.210	-	997	2
30	MAKEUP WATER	-	16	-	210	-	1.0	-	60	-	998	2
31	COMPRESSED AIR	-	21	-	620	-	0.006	-	0.001	-	8.346	

NOTES:
1. VALUE UNCERTAIN AT THIS TIME.
2. WATER VOLUME FLOWS IN l/m.

	SPEC No
(01) MATERIAL HANDLING GATE VALVES. ALL OTHERS SUPPLIED WITH EQUIPMENT.	251-1
(DX) FLUE GAS DAMPERS	252-1
(21) EXPANSION JOINTS	253-1

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

Drawn	Check	Approval	Issued For	Date	Rev	Description of Revision
LR	DHB	GL	MILESTONE ISSUE		O	
LR			FINAL REPORT ISSUE		A	COOLING & CIRCULATION WATER SYSTEM REVISED

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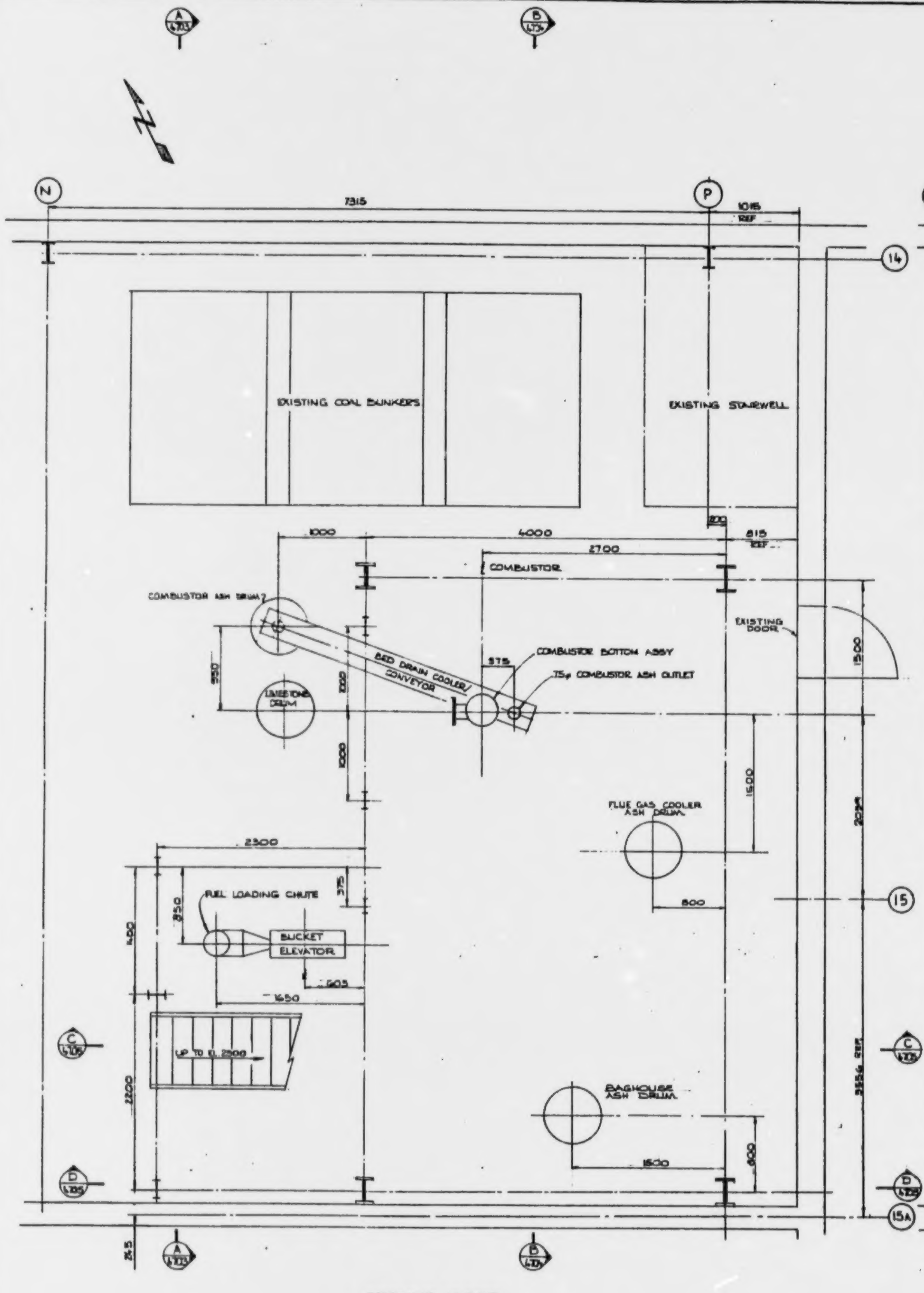
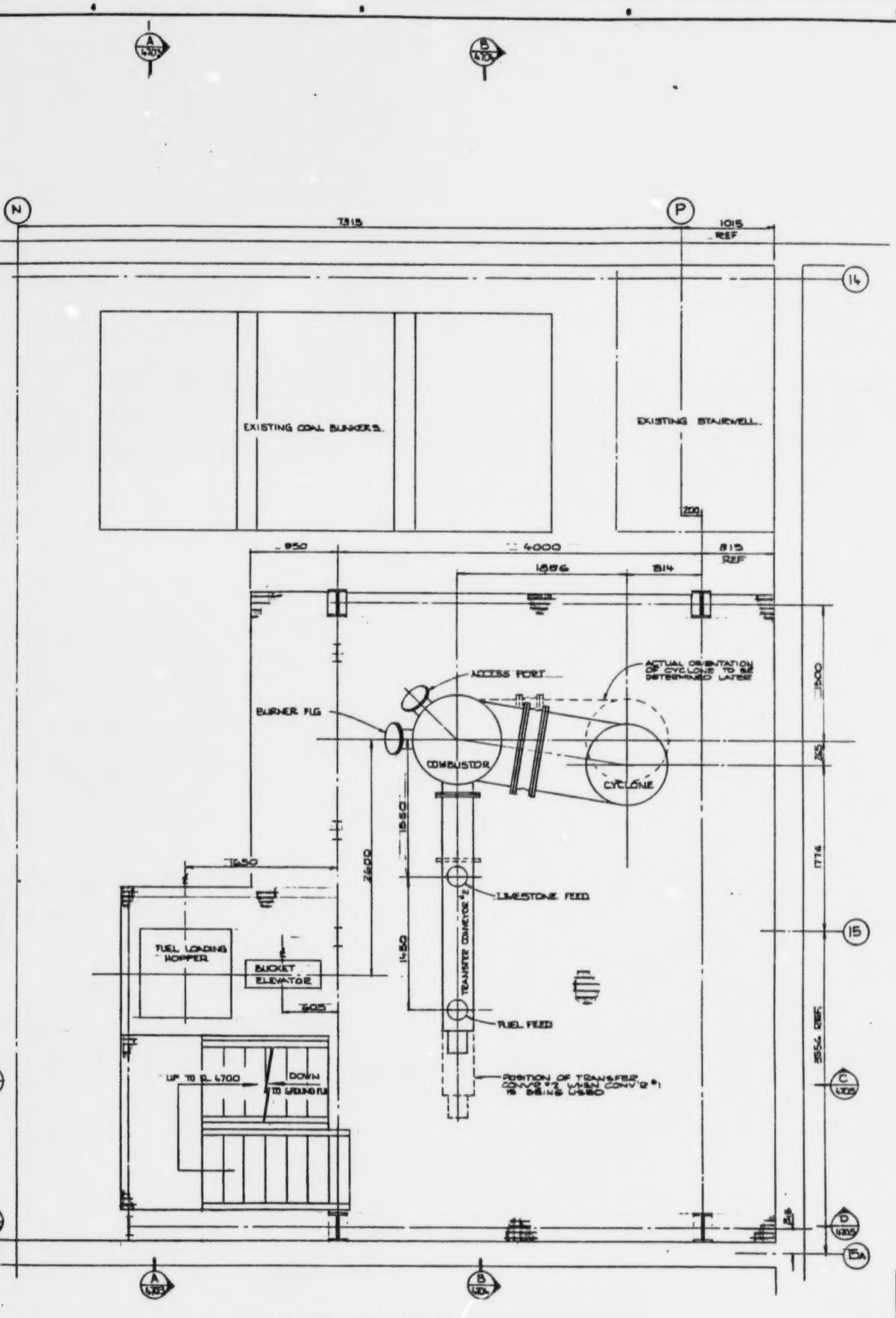
ARFBC: RESEARCH FACILITY
P & I DIAGRAM

Drawn L.R.
Approved j.R.
Date 27 JAN 83

AO 0243 ! 4601 A


A 4703
B 4704
N
P
7315
1015 REF
14
15
15A
EXISTING COAL BUNKERS
EXISTING STAIRWELL
EXISTING DOOR
1000
4000
2700
200
815 REF
COMBUSTOR
COMBUSTOR ASH DRUM
BED DRAIN COOLER/CONVEYOR
575
COMBUSTOR BOTTOM ASSY
75φ COMBUSTOR ASH OUTLET
LIMESTONE DRUM
550
1000
1500
FLUE GAS COOLER ASH DRUM
800
2300
FUEL LOADING CHUTE
BUCKET ELEVATOR
850
375
400
605
1650
UP TO EL 2300
2200
BAGHOUSE ASH DRUM
1800
600
2029
2556 REF
C 4705
D 4705
85

GROUND FLOOR


A 4703
B 4704
N
P
7315
1015 REF
14
15
15A
EXISTING COAL BUNKERS
EXISTING STAIRWELL
200
850
4000
815 REF
1886
514
ACCESS PORT
ACTUAL ORIENTATION OF CYCLONE TO BE DETERMINED LATER
BURNER FLG
COMBUSTOR
CYCLONE
1500
1850
2600
1650
LIMESTONE FEED
TRANSFER CONVEYOR #2
1450
FUEL LOADING HOPPER
BUCKET ELEVATOR
605
FUEL FEED
UP TO EL 4700
DOWN TO GROUND FLR
POSITION OF TRANSFER CONV'R #2 WHEN CONV'R #1 IS BEING USED
1774
3556 REF
C 4705
D 4705

PLATFORM EL. 2300

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

Drawn	Check	Issued For	Date	Rev	Description of Revision
LR		REVIEW	[illegible]	O	
LR		REVIEW	[illegible]	A	GENERAL REVISION
LR	DNB	MILESTONE ISSUE	[illegible]	B	
LR		FINAL REPORT ISSUE	[illegible]	C	GENERAL REVISION.

Scale 1:20

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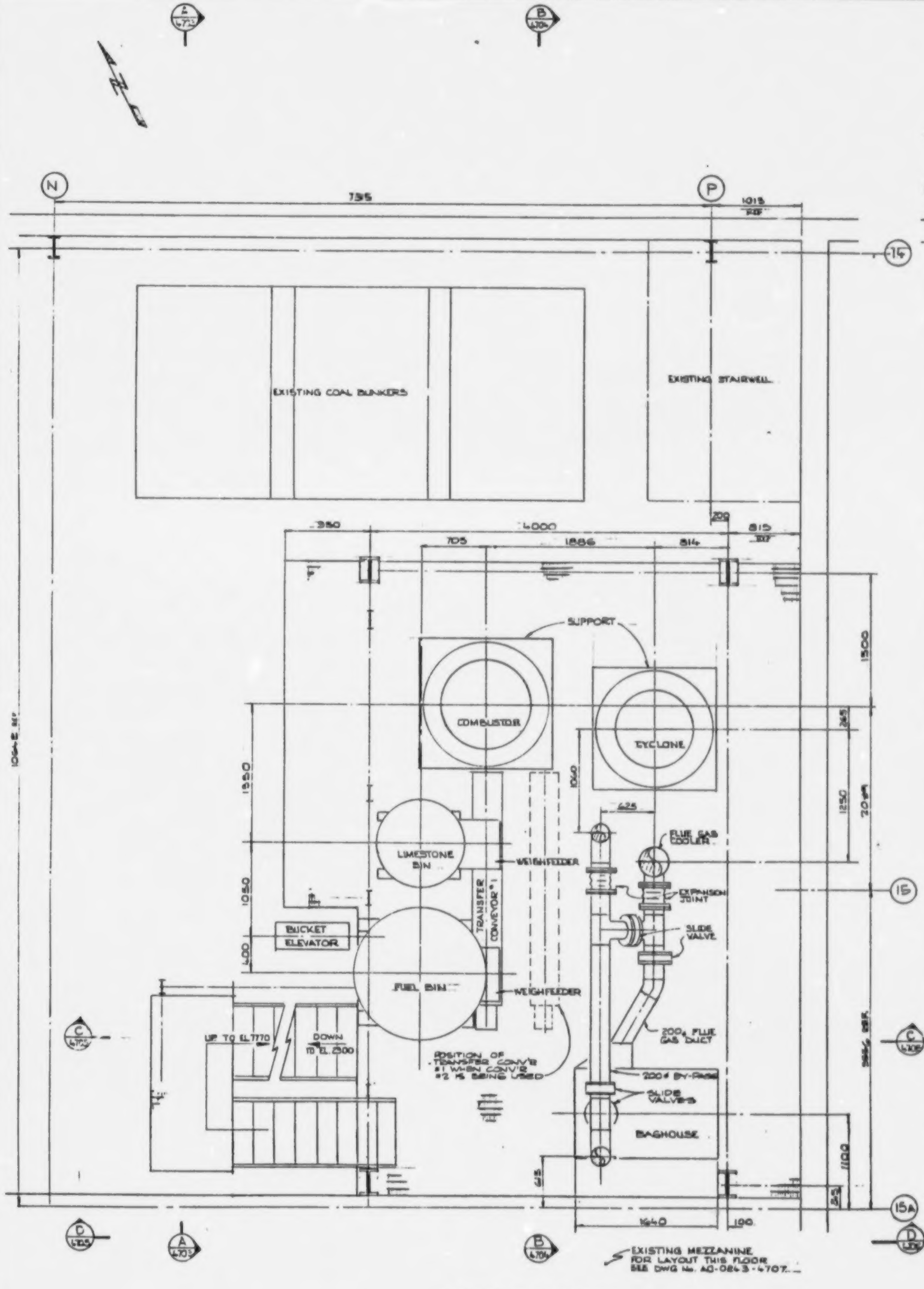
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
GROUND FLOOR & PLATFORM EL 2300

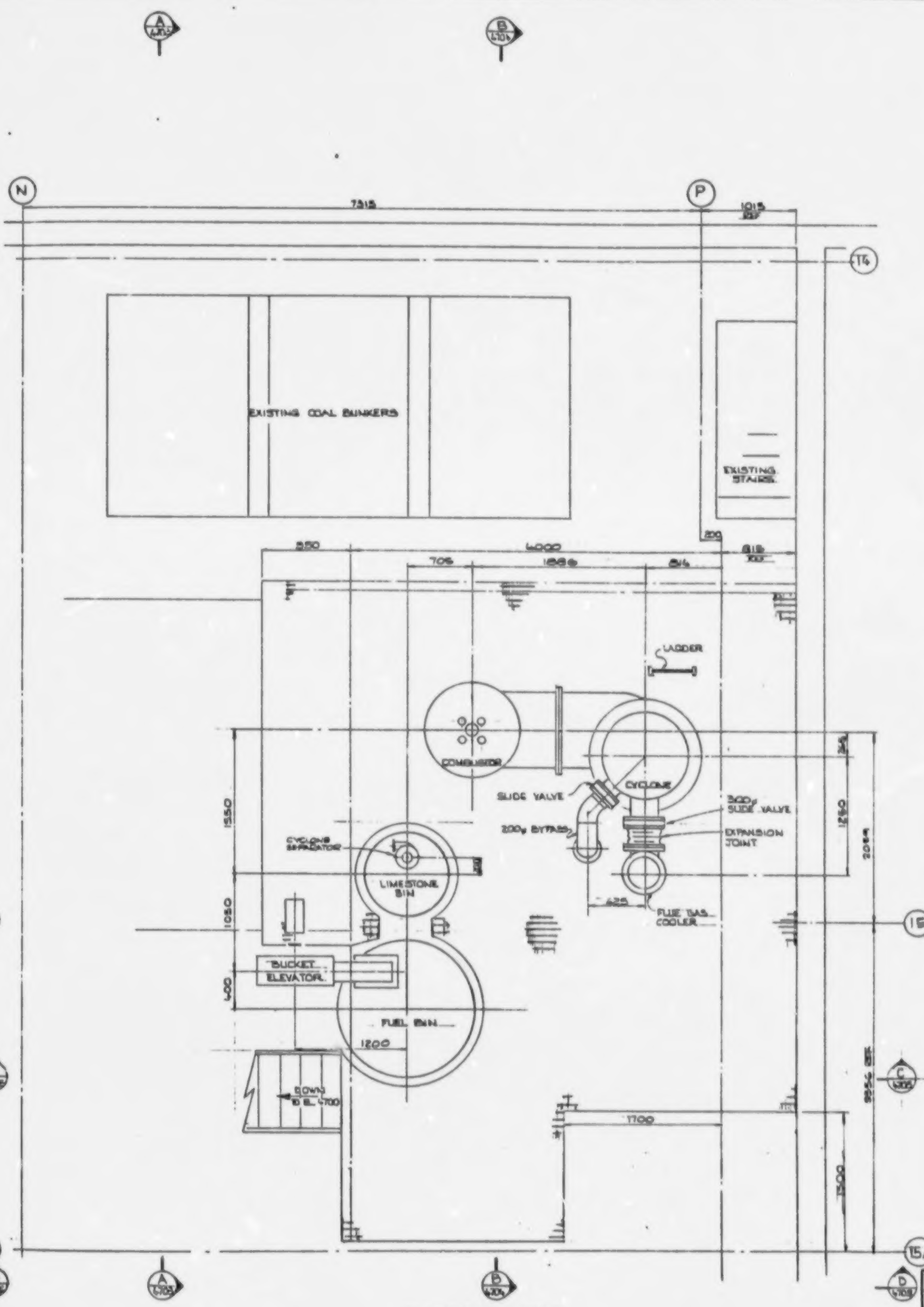
Drawn RRR/VLC
Date 13 SEPT 83

Dwg No. AO 0243 4701 C


A 4703
B 4704
N
P
7315
1015
T4
EXISTING COAL BUNKERS
EXISTING STAIRWELL
350
4000
705
1886
814
815
200
SUPPORT
COMBUSTOR
CYCLONE
1500
1550
245
1040
1250
2084
425
FLUE GAS COOLER
LIMESTONE BIN
WEIGHFEEDER
TRANSFER CONVEYOR #1
EXPANSION JOINT
1050
15
BUCKET ELEVATOR
SLIDE VALVE
400
FUEL BIN
WEIGHFEEDER
200φ FLUE GAS DUCT
C 4705
UP TO EL 7770
DOWN TO EL 2300
POSITION OF TRANSFER CONV'R #1 WHEN CONV'R #2 IS BEING USED
200φ BY-PASS
SLIDE VALVES
BAGHOUSE
1100
615
15A
D 4705
1640
100
A 4703
B 4704
D 4706

EXISTING MEZZANINE FOR LAYOUT THIS FLOOR SEE DWG No. AO-0243-4707.

PLATFORM EL 4700


A 4703
B 4704
N
P
7315
1015
T4
EXISTING COAL BUNKERS
EXISTING STAIRS
200
350
4000
705
1886
814
815
LADDER
COMBUSTOR
CYCLONE
SLIDE VALVE
300φ SLIDE VALVE
EXPANSION JOINT
200φ BYPASS
CYCLONE SEPARATOR
LIMESTONE BIN
1550
1250
2084
425
FLUE GAS COOLER
1050
15
BUCKET ELEVATOR
400
FUEL BIN
1200
C 4705
DOWN TO EL 4700
1700
1500
15A
A 4703
B 4704
D 4705

PLATFORM EL 7770

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LR						REVIEW		0	
LR						REVIEW		A	GENERAL REVISION
LR		DB				MILESTONE ISSUE		B	
LR						FINAL REPORT ISSUE		C	GENERAL REVISION.

Scale 1:50

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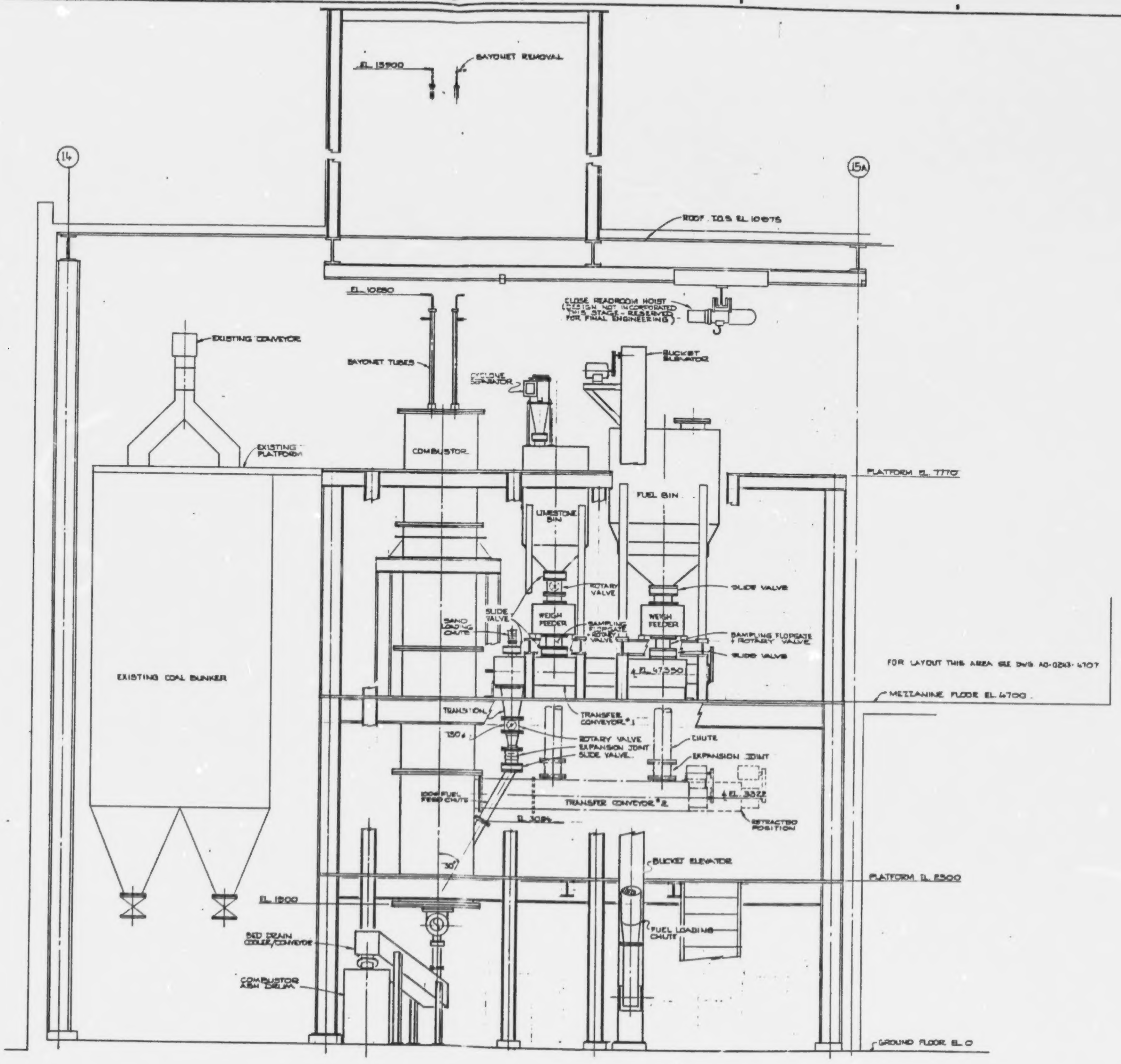
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
PLATFORM EL 4700 & 7770

L. REEVES
3 OCT 8[illegible]

AO 0243 4702 C


EL 15900
BAYONET REMOVAL
14
15A
ROOF T.O.S. EL 10675
EL 10880
CLOSE HEADROOM HOIST (DESIGN NOT INCORPORATED THIS STAGE - RESERVED FOR FINAL ENGINEERING)
EXISTING CONVEYOR
BAYONET TUBES
CYCLONE SEPARATOR
BUCKET ELEVATOR
EXISTING PLATFORM
COMBUSTOR
PLATFORM EL 7770
FUEL BIN
LIMESTONE BIN
ROTARY VALVE
SLIDE VALVE
SLIDE VALVE
WEIGH FEEDER
WEIGH FEEDER
SAND LOADING CHUTE
SAMPLING FLOPGATE + ROTARY VALVE
SAMPLING FLOPGATE + ROTARY VALVE
SLIDE VALVE
EL 47350
FOR LAYOUT THIS AREA SEE DWG A0-0243-4707
EXISTING COAL BUNKER
MEZZANINE FLOOR EL 4700
TRANSITION
TRANSFER CONVEYOR #1
150φ
ROTARY VALVE
EXPANSION JOINT
SLIDE VALVE
CHUTE
EXPANSION JOINT
100φ FUEL FEED CHUTE
TRANSFER CONVEYOR #2
EL 3322
EL 3084
RETRACTED POSITION
30°
BUCKET ELEVATOR
PLATFORM EL 2500
EL 1900
BED DRAIN COOLER/CONVEYOR
FUEL LOADING CHUTE
COMBUSTOR ASH DRUM
GROUND FLOOR EL 0

SECTION A/4701 A/4702

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

Drawn		Check		Approval		Issued For	Date	Rev	Description of Revision
LR					[illegible]	REVIEW	[illegible] 83	0	
LR					[illegible]	REVIEW	[illegible] 83	A	GENERAL REVISION.
LR		DB			GC	MILESTONE ISSUE	[illegible]	B	
LR					GC	FINAL REPORT ISSUE	[illegible]	C	GENERAL REVISION.

Scale 1:20

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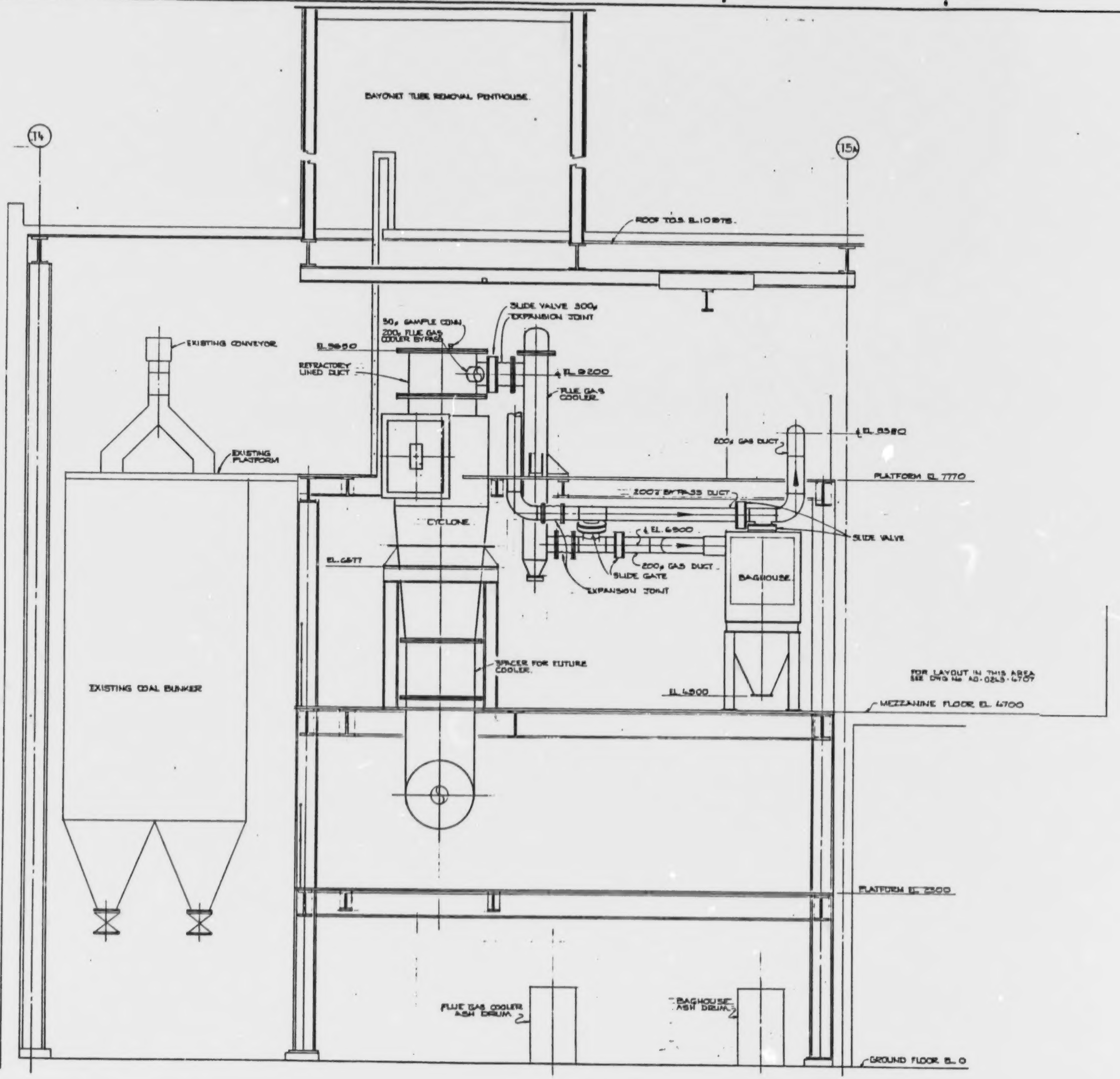
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
SECTION A

Drawn L. REEVES
Date 3 SEPT 82

A0 0243 4705 C


BAYONET TUBE REMOVAL PENTHOUSE.
14
15A
ROOF T.O.S. EL.10975.
EXISTING CONVEYOR
EL.9650
REFRACTORY LINED DUCT
50φ SAMPLE CONN.
200φ FLUE GAS COOLER BYPASS
SLIDE VALVE 300φ
EXPANSION JOINT
EL.9200
FLUE GAS COOLER
EXISTING PLATFORM
200φ GAS DUCT
EL.8580
PLATFORM EL.7770
200φ BYPASS DUCT
CYCLONE
EL.6900
SLIDE VALVE
EL.6577
200φ GAS DUCT
SLIDE GATE
EXPANSION JOINT
BAGHOUSE
SPACER FOR FUTURE COOLER.
EXISTING COAL BUNKER
FOR LAYOUT IN THIS AREA SEE DWG No. A0-0243-4707
EL.4900
MEZZANINE FLOOR EL.4700
PLATFORM EL.2300
FLUE GAS COOLER ASH DRUM
BAGHOUSE ASH DRUM
GROUND FLOOR EL.0

SECTION B/4701 B/4702

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

						Issued For	Date	Rev	Description of Revision
LR						REVIEW	[illegible] 83	0	
LR						REVIEW	[illegible] 83	A	GENERAL REVISION
LR		DNB				MILESTONE ISSUE	[illegible]	B	
LR						FINAL REPORT ISSUE	[illegible]	C	GENERAL REVISION

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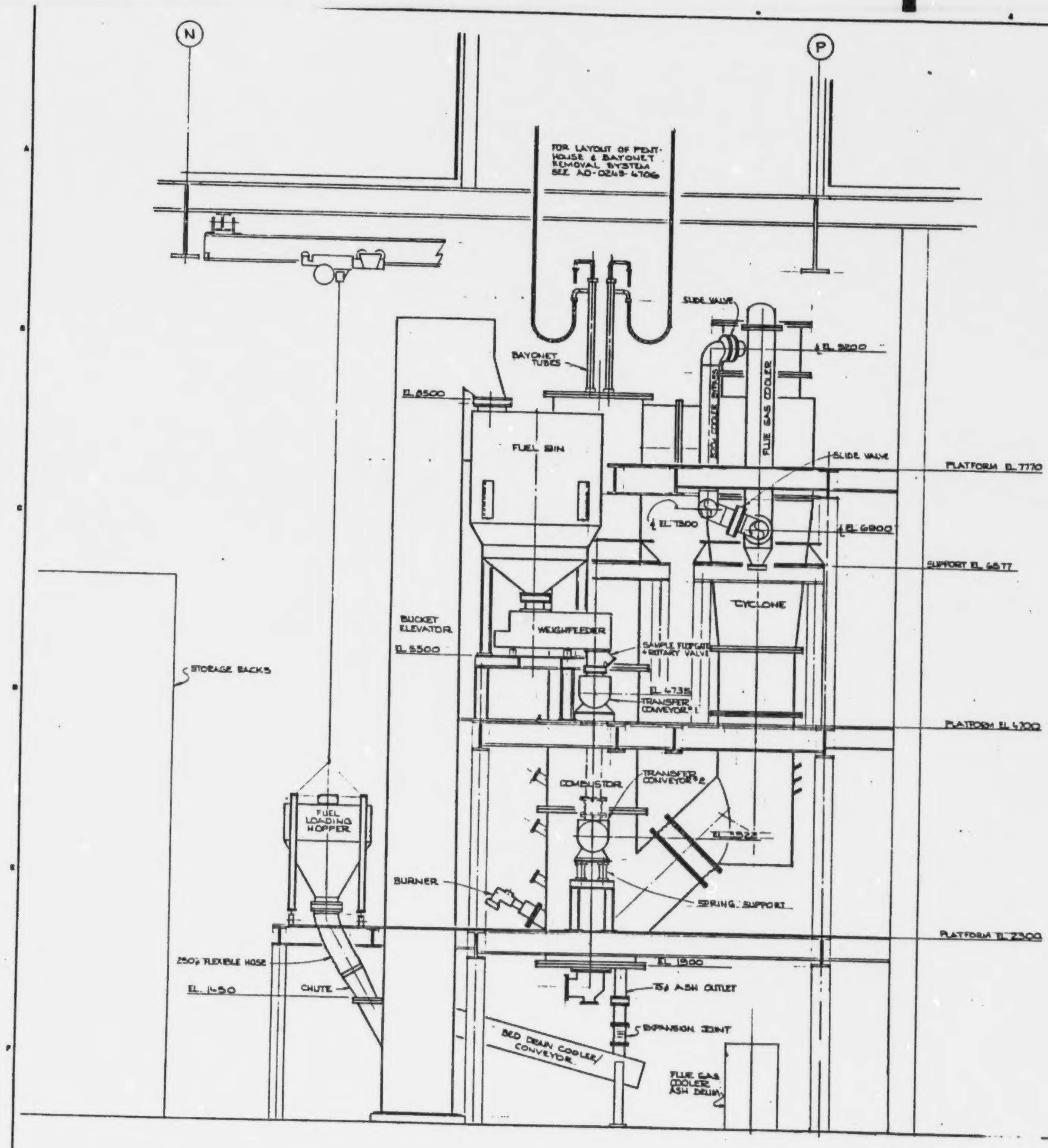
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
SECTION B

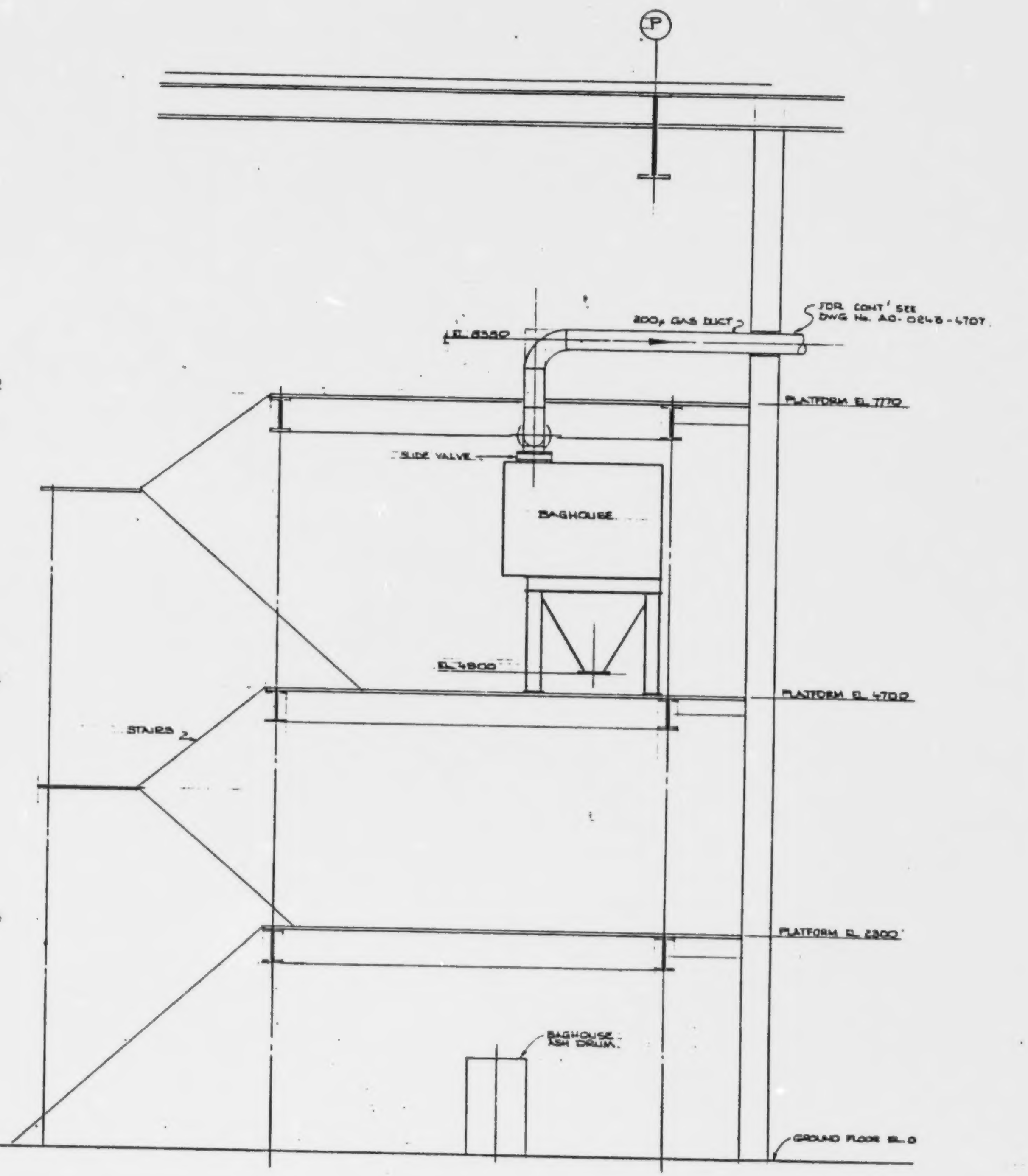
Drawn L. REEVES
Date 19 SEPT. 83

Scale 1:20

A0 0243 4704 C


N
P
FOR LAYOUT OF PENT-HOUSE & BAYONET REMOVAL SYSTEM SEE AO-0243-4706
SLIDE VALVE
BAYONET TUBES
EL 9200
EL 8500
FUEL BIN
COOLER BYPASS
FLUE GAS COOLER
SLIDE VALVE
PLATFORM EL 7770
EL 7300
EL 6900
SUPPORT EL 6577
CYCLONE
BUCKET ELEVATOR
WEIGHFEEDER
EL 5500
SAMPLE FLIPGATE + ROTARY VALVE
STORAGE RACKS
EL 4735
TRANSFER CONVEYOR #1
PLATFORM EL 4700
COMBUSTOR
TRANSFER CONVEYOR #2
FUEL LOADING HOPPER
EL 3522
BURNER
SPRING SUPPORT
PLATFORM EL 2300
EL 1900
250φ FLEXIBLE HOSE
75φ ASH OUTLET
EL 1450
CHUTE
EXPANSION JOINT
BED DRAIN COOLER/ CONVEYOR
FLUE GAS COOLER ASH DRUM

SECTION C/4701 C/4702


P
EL 8350
200φ GAS DUCT
FOR CONT' SEE DWG No. AO-0243-4707
PLATFORM EL 7770
SLIDE VALVE
BAGHOUSE
EL 4900
PLATFORM EL 4700
STAIRS
PLATFORM EL 2300
BAGHOUSE ASH DRUM
GROUND FLOOR EL 0

SECTION D/4701 D/4702

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

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LR						REVIEW	[illegible]	0
LR		DNB			GLC	MILESTONE ISSUE	[illegible]	A
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SECTION C & D

Drawn L. REEVES
Approved FW
Date Nov 83

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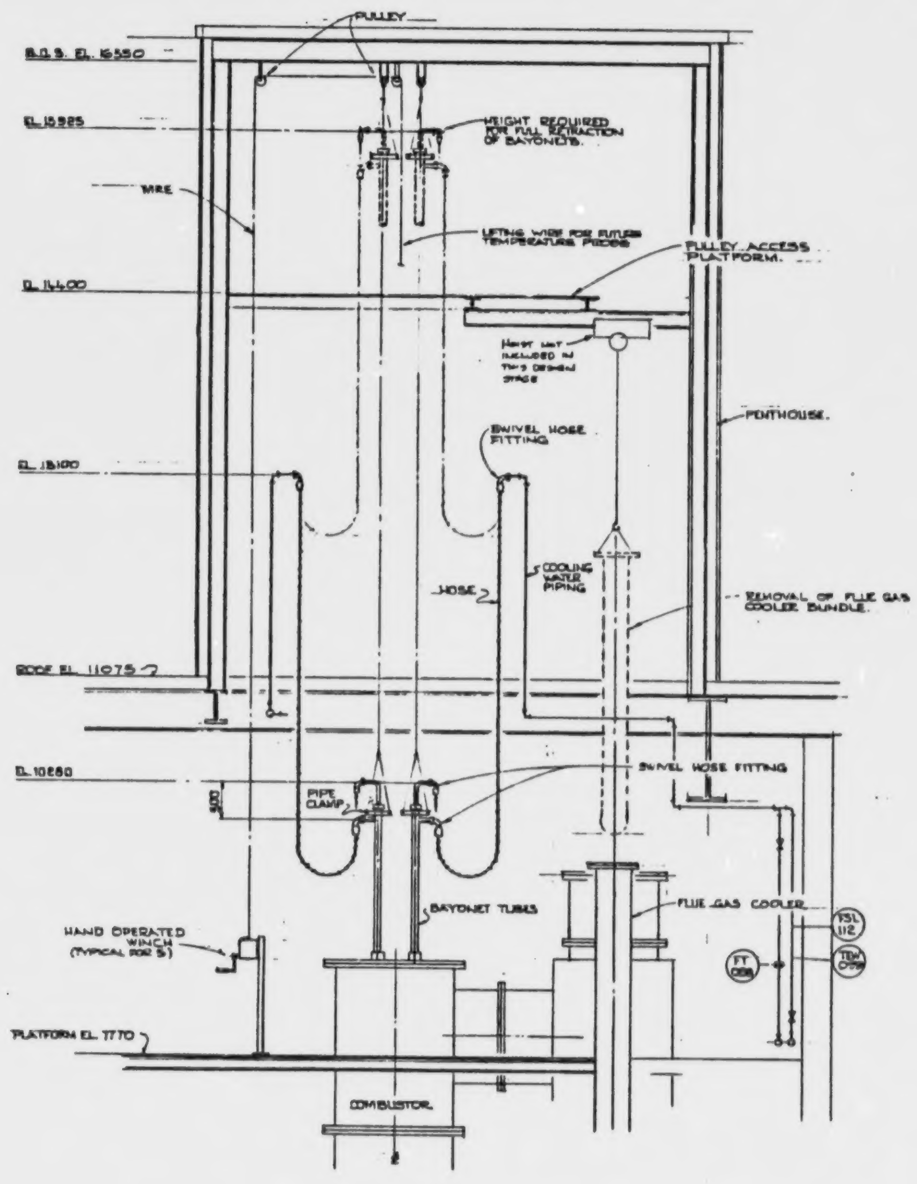
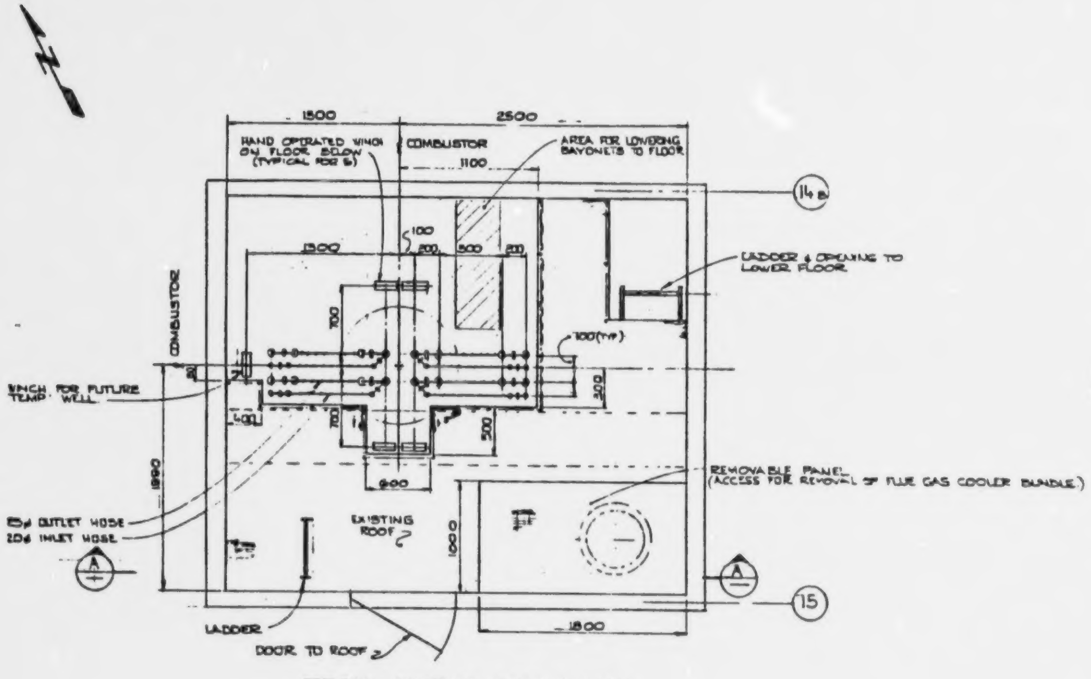
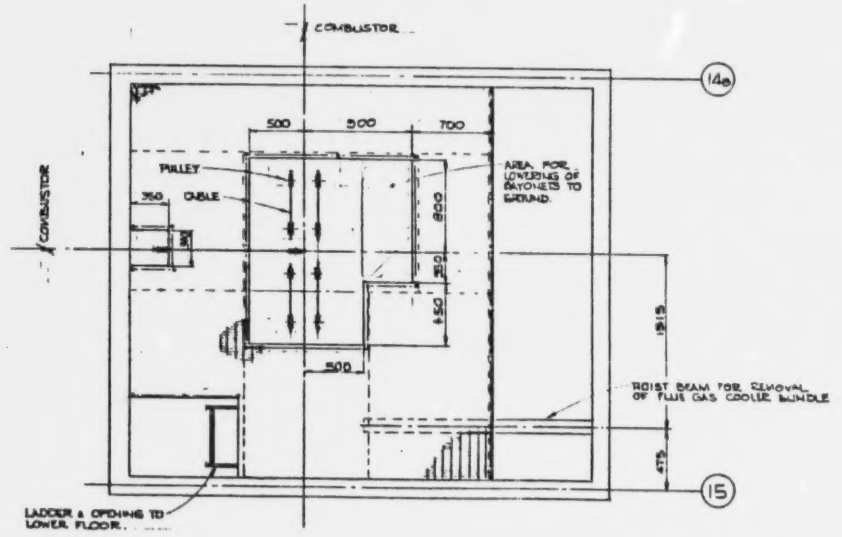
Dwg No. AO 0243 — 4705 B


PULLEY
B.O.S. EL. 16550
EL. 15925
HEIGHT REQUIRED FOR FULL RETRACTION OF BAYONETS.
WIRE
LIFTING WIRE FOR FUTURE TEMPERATURE PROBES
PULLEY ACCESS PLATFORM.
EL. 14400
HOIST UNIT INCLUDED IN THIS DESIGN STAGE
PENTHOUSE.
SWIVEL HOSE FITTING
EL. 13100
COOLING WATER PIPING
HOSE
REMOVAL OF FLUE GAS COOLER BUNDLE.
ROOF EL. 11075
EL. 10280
SWIVEL HOSE FITTING
PIPE CLAMP
300
BAYONET TUBES
FLUE GAS COOLER
TSL 112
FT 088
TEW 059
HAND OPERATED WINCH (TYPICAL FOR 5)
PLATFORM EL. 7770
COMBUSTOR

SECTION (A)


N
1500
2500
HAND OPERATED WINCH ON FLOOR BELOW (TYPICAL FOR 5)
COMBUSTOR
AREA FOR LOWERING BAYONETS TO FLOOR
1100
14B
100
1300
200
300
200
LADDER & OPENING TO LOWER FLOOR
COMBUSTOR
700
100(TYP)
WINCH FOR FUTURE TEMP. WELL
300
400
700
500
900
1990
REMOVABLE PANEL (ACCESS FOR REMOVAL OF FLUE GAS COOLER BUNDLE)
25φ OUTLET HOSE
20φ INLET HOSE
EXISTING ROOF
1000
A
A
15
1800
LADDER
DOOR TO ROOF

PLAN - EXISTING ROOF EL. 11075


COMBUSTOR
14B
500
500
700
PULLEY
CABLE
350
AREA FOR LOWERING OF BAYONETS TO GROUND.
COMBUSTOR
800
350
450
1515
500
HOIST BEAM FOR REMOVAL OF FLUE GAS COOLER BUNDLE
475
15
LADDER & OPENING TO LOWER FLOOR.

PLAN - FLOOR EL. 14400

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

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ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
PENTHOUSE & BAYONET TUBE
REMOVAL SYSTEM

Drawn L. REEVES
Approved
Date 27 SEPT 83

Scale 1:20

AO 0243 4706 B

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LL						REVIEW	[illegible]	0	
LR		DNB			GAC	MILESTONE ISSUE	[illegible]	A	
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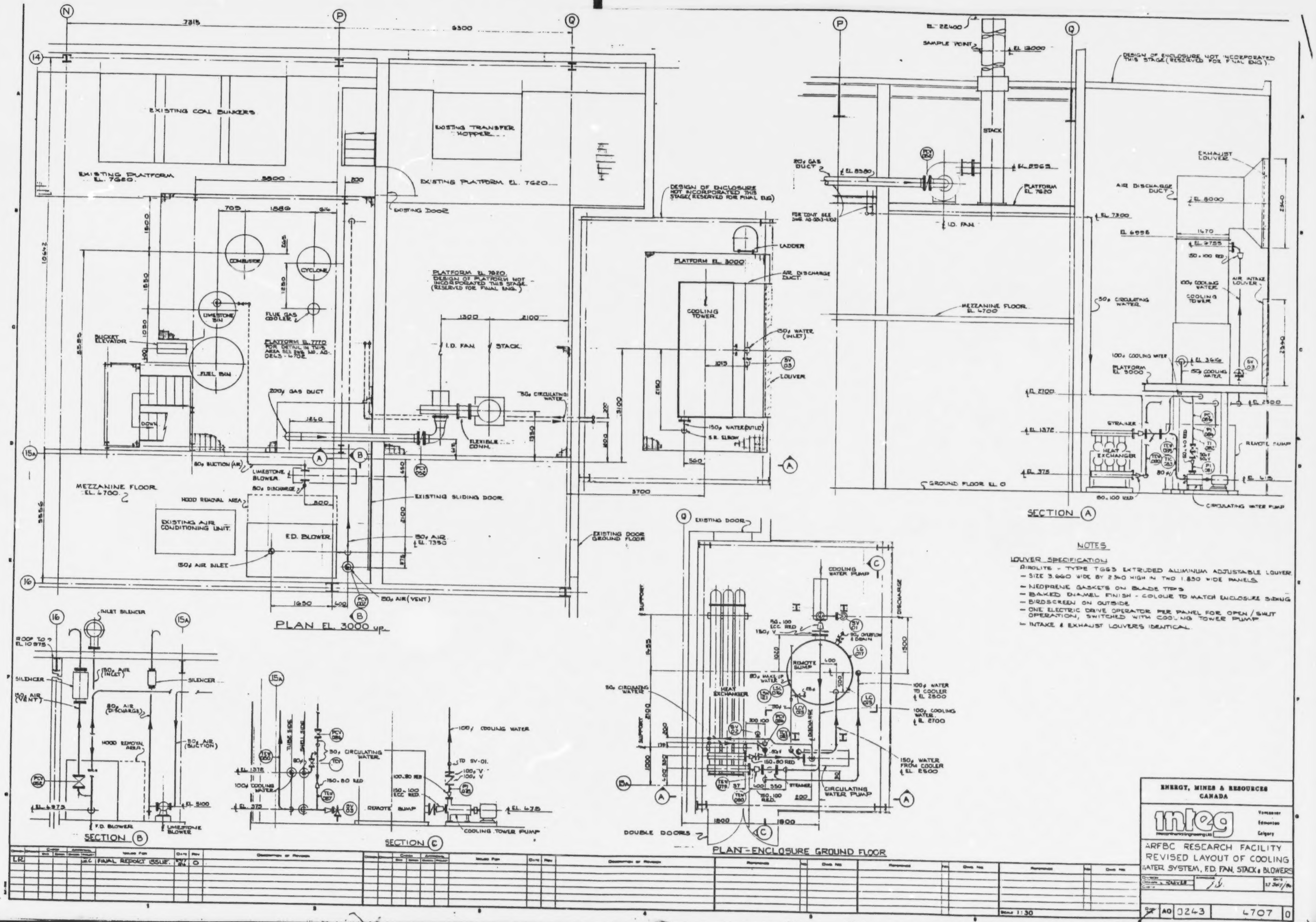
PLAN EL. 3000 up
EXISTING COAL BUNKERS
EXISTING TRANSFER HOPPER
EXISTING PLATFORM EL. 7620
EXISTING PLATFORM EL. 7620
EXISTING DOOR
COMBUSTOR
CYCLONE
FLUE GAS COOLER
LIMESTONE BIN
FUEL BIN
BUCKET ELEVATOR
PLATFORM EL 7770 FOR DETAIL IN THIS AREA SEE DWG. NO. AO-DEL3-4702
PLATFORM EL 7620. DESIGN OF PLATFORM NOT INCORPORATED THIS STAGE. (RESERVED FOR FINAL ENG.)
I.D. FAN
STACK
200ø GAS DUCT
80ø CIRCULATING WATER
FLEXIBLE CONN.
80ø SUCTION (AIR)
LIMESTONE BLOWER
80ø DISCHARGE
HOOD REMOVAL AREA
EXISTING SLIDING DOOR
MEZZANINE FLOOR EL. 4700
EXISTING AIR CONDITIONING UNIT
F.D. BLOWER
150ø AIR INLET
150ø AIR EL. 7350
150ø AIR (VENT)
EXISTING DOOR GROUND FLOOR
DESIGN OF ENCLOSURE NOT INCORPORATED THIS STAGE (RESERVED FOR FINAL ENG)
LADDER
PLATFORM EL. 3000
AIR DISCHARGE DUCT
COOLING TOWER
150ø WATER (INLET)
LOUVER
150ø WATER (OUTLET)
S.R. ELBOW
SECTION A
EL. 22400
SAMPLE POINT
EL. 13000
200ø GAS DUCT
EL. 8580
EL. 8565
PLATFORM EL 7620
FOR CONT. SEE DWG. AO-DEL3-4702
I.D. FAN
MEZZANINE FLOOR EL. 4700
GROUND FLOOR EL. 0
DESIGN OF ENCLOSURE NOT INCORPORATED THIS STAGE (RESERVED FOR FINAL ENG.)
EXHAUST LOUVER
AIR DISCHARGE DUCT
EL. 8000
EL. 7300
EL. 6958
150 x 100 RED
100ø COOLING WATER
AIR INTAKE LOUVER
COOLING TOWER
150ø CIRCULATING WATER
100ø COOLING WATER
EL. 3616
PLATFORM EL. 3000
EL. 2700
EL. 2300
STRAINER
HEAT EXCHANGER
EL. 1376
EL. 375
EL. 415
REMOTE PUMP
80 x 100 RED
CIRCULATING WATER PUMP
SECTION B
INLET SILENCER
ROOF TO EL. 10975
SILENCER
150ø AIR (INLET)
150ø AIR (VENT)
80ø AIR (DISCHARGE)
HOOD REMOVAL AREA
80ø AIR (SUCTION)
EL. 4975
EL. 5100
F.D. BLOWER
LIMESTONE BLOWER
SECTION C
TUBE SIDE
SHELL SIDE
80ø CIRCULATING WATER
150 x 80 RED
100ø COOLING WATER
100ø COOLING WATER
TO SV-01
REMOTE SUMP
150 x 100 ECC. RED
COOLING TOWER PUMP
EL. 475
PLAN - ENCLOSURE GROUND FLOOR
EXISTING DOOR
COOLING WATER PUMP
DISCHARGE
SUPPORT
REMOTE SUMP
HEAT EXCHANGER
80ø CIRCULATING WATER
80ø MAKE-UP WATER
150ø OVERFLOW & DRAIN
100ø WATER TO COOLER EL. 2500
100ø COOLING WATER EL. 2700
150ø WATER FROM COOLER EL. 2500
STRAINER
CIRCULATING WATER PUMP
DOUBLE DOORS
SCALE 1:30

NOTES

LOUVER SPECIFICATION

AIROLITE - TYPE T663 EXTRUDED ALUMINUM ADJUSTABLE LOUVER
- SIZE 3,660 WIDE BY 2340 HIGH IN TWO 1,830 WIDE PANELS
- NEOPRENE GASKETS ON BLADE TIPS
- BAKED ENAMEL FINISH - COLOUR TO MATCH ENCLOSURE SIDING
- BIRDSCREEN ON OUTSIDE
- ONE ELECTRIC DRIVE OPERATOR PER PANEL FOR OPEN / SHUT OPERATION, SWITCHED WITH COOLING TOWER PUMP
- INTAKE & EXHAUST LOUVERS IDENTICAL.

L.R.		FINAL REPORT ISSUE.		0

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ARFBC RESEARCH FACILITY
REVISED LAYOUT OF COOLING
WATER SYSTEM, F.D. FAN, STACK & BLOWERS

27 July/84

AO 0243 4707 0

APPENDIX III

LOOP SEAL DESIGN VERIFICATION TEST REPORT

Pilot plant testing of L-valve component in both hot and cold modes by GA Technologies.

Milestone Report, 20 January 1984.

GA Technologies

GA Technologies Inc.
P.O. BOX 81608
SAN DIEGO, CALIFORNIA 92138
(619) 455-3000

PTB:HHY:70:84
April 30, 1984

Mr. Grant R. Cooper
INTEG
1155 West Pender Street
Vancouver, British Columbia
Canada V6E 2PA

Dear Grant:

The attached "Loop Seal Design Verification" test report incorporates all of Dilip Desai's comments and is now issued as the formal release. Please replace the review copies I sent you in January or update the following pages in the review copies:

P. 3-13
P. 3-15
P. 4-10
P. 4-15
P. 4-16
P. 4-23

integ
MAY 1 - 1984
GRC
FILE

Regards,

Harry Yip

Harry Y. Yip
Project Manager

HHY/ec
Attachments: 3 Copies

GA Technologies

CANMET RFBC
LOOP SEAL DESIGN VERIFICATION
TEST REPORT

by
GA TECHNOLOGIES

Prepared under
Subcontract No. BD 7000-134
for INTEG

JANUARY 1984

L-VALVE LOOP SEAL

DESIGN VERIFICATION TEST

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1.

INTRODUCTION

1. Introduction

GA Technologies conducted L-valve performance verification test in the 0.4 meters circulating fluidized-bed combustor in San Diego, California. The test conducted included both a cold Plexiglas model test and hot combustion mode test. The primary purpose of the test was to obtain design and performance data in support of a detailed combustor system design undertaken by GA Technologies for CANMET.

2.

OBJECTIVES

2. Objective

The objective of this test program is to verify an L-valve solids circulating system design and obtain operating characteristics in a 0.4 meter circulating fluidized bed combustor, as defined in GA Proposal GACP33-248. The test is divided into two parts. A cold Plexiglas system followed by hot combustion mode verification test.

2.1 Cold Test

The scope of the cold test includes fabrication of a Plexiglas L-valve and operation of the 0.4 meter CFBC in a cold mode to obtain the following information:

1. Determination of "L" valve mass flow rate vs. aeration air flow for two aeration tap locations and two combustor superficial velocities.
2. Correlation of standpipe height with standpipe DP.
3. Evaluation of "L" valve control philosphy, (self adjusting vs. varying aeration). Control of the "L" valve will be manual in the test.
4. Verification of minimum cyclone standpipe height required to overcome combustor back pressure.

2.2 Hot Verification Test

Based on optimum "L" valve performance determined during the cold test, a stainless steel "L" valve will be fabricated and tested as a component in the 400 mm combustor.

3.

COLD PLEXIGLAS MODEL TEST

3. Cold Plexiglas Model Test

3.1 Test Description

A 6" (0.15 meter) I.D. Plexiglas L"-valve and stand pipe were built and installed in the 0.4 meter CFBC in the GA pilot plant. This transparent Plexiglas system enabled us to visually observe the flow, fluidization characteristic of the particles in the stand pipe and in the L-valve as well as the stand pipe leg height required to overcome the bed back pressure for circulating the particles. A video-tape record of this visual observation was made and is available for inspection. In this cold test three system configurations were tested. These configurations were:

1. L-valve

2. L-valve with a baffle

3. Inclined L-valve (30° from Horizontal)

During the cold test we found that we could not operate the system higher than 10 ft/sec (3.05 m/s) bed velocity. An attempt to operate the system at higher velocities resulted in pressurizing the system to an unacceptable degree even though the filters were pulled out from the baghouses in order to mitigate the system pressure. The size distributon of the silica sand used as bed material during the cold tests is given in Figure A-1.

3.2 Test Results

(A) L-Valve

The dimensions of the L-valve constructed for this test is given in Figure A-2. The system was equipped with 5 aeration and 7 pressure taps.

During the operation of the unit a lot of slugging was noticed in the stand pipe. This is due to the inability of the L-valve to hold the seal against the slugging bed back pressure from the burner riser. We suspect at the operating velocities 8 to 10 ft/sec (2.44 - 3.05 m/s) we may be operating at the transition region between the fluidized and fast fluidized bed region, thus resulting in high slugging. Thus this problem of slugging in the stand pipe may be reduced by operating the burner at much higher velocities. Due to system back pressure, our equipment configuration did not allow us to operate the system at higher velocities. Thus in order to reduce the slugging in the stand pipe and to obtain acceptable performance of the system at low velocity ranges a 2" baffle (segment) was placed in the horizontal section of the L-valve. Figure A-3 shows the location of the baffle in the L-valve system.

(B) Modified L-Valve (Baffled L-Valve) Test

An insert 2" baffle segment was placed in the L-valve described in Section A. The baffle was placed in the horizontal section at the intersection of the vertical and horizontal section. The baffle was found to greatly reduce the slugging in the stand pipe. Table A-1 summarizes the results obtained during this test. Figure A-4, A-5, and A-6 show the relationship between stand pipe leg height vs stand pipe pressure and stand pipe pressure drop vs combustor (riser) pressure drop. Figure A-7 shows the relationship between L-valve aeration and solids mass flow rate.

Some of the significant results obtained in the Baffled L-valve test include:

(1) Presence of a baffle segment virtually eliminated the slugging and gas bubbling in the stand pipe.

(2) Generally speaking it was found that higher stand pipe leg height was required when operating the bed at higher velocity (higher velocity results in higher bed pressure drop thus higher pressure to overcome at the solids return port.) Figure A-6 shows the relationship between bed DP and stand pipe DP. Figure A-8 shows the relationship between bed superficial velocity and stand pipe leg height.

(3) The stand pipe leg height was not found to be affected by the amount of aeration introduced into the L-valve, i.e. the stand pipe leg height is self regulating. The leg height varies to overcome the burner pressure at the solids return loop.

(4) Very little aeration, as little as 30 SLPM ($\sim$1.1 scfm), is required to initiate solids flow. After initiation of flow it was found that the solids mass flow was almost independent of the valve aeration rate. Figure A-7 shows the relationship between valve aeration and solids mass flow rate.

(5) The stand pipe leg height never got higher than 60 inches under the test conditions.

(C) Inclined L-valve Test

The Inclined L-valve idea was conceived in order to develop an alternate design to the Baffled L-valve concept. The Inclined L-valve (so called because of the 30° incline to the horizontal section) was found to greatly increase the seal and maintain it against the burner back pressure without the use of a baffle. Figure A-9 shows the Inclined Plexiglas L-valve configuration tested.

TABLE A-1

L-VALVE COLD TEST DATA (Baffled L-Valve)

					STAND PIPE SECTION ΔP ("W.C)								
PRESSURE TAP LOCATION					ΔP_1	ΔP_2	ΔP_3	ΔP_4	ΔP_5	ΔP_6	ΔP_7		
ABOVE L-VALVE (INCHES)					9"	15"	27"	39"	51"	3.5"			
DATE	TIME	BED VELOCITY FT/S	CYCLONE PRESSURE "W.C	AERATION TAP LOCATION AND FLOW (SLPM)								STAND PIPE LEG HEIGHT (INCHES)	BED P ("W.C)
9/21/83	23:55	8.7	36	#5 (220)	42	38	33	20	6	6	N/A	33	28
9/22/83	09:30	4.6	N/A	No Aeration	25	22	15	0	0	0	24	N/A	N/A
9/22/83	09:41	6.4	-3	No Aeration	39	38	34	20	4	2	32	36-48	44
9/22/83	10:00	5.7	8	#5 (120)	42	42	35	22	4	3	30	36-48	42
9/23/83	10:40	9.6	22	No Aeration	90	90	85	70	30	26	30	48-60	52
9/23/83	12:15	9.6	24	No Aeration	90	90	80	70	40	36	30	48-60	54
9/23/83	12:50	9.6	24	No Aeration	90	90	80	70	30	26	30	48-60	54
9/23/83	13:45	9.8	25	#4 (100)	89	90	81	70	20	20	40	48-60	50

Table A-2 summarizes the results obtained during the test.

Figures A-10 and A-13 show the relationship between stand pipe leg height and stand pipe pressure drop for two different valve aeration rates.

Figure A-14 shows the relationship between bed superficial velocity and stand pipe leg height. Generally speaking higher stand pipe leg height and pressure drop were observed when operating at higher superficial velocity.

Figure A-15 shows the relationship between Combustor Bed DP and stand pipe DP. Figure A-16 shows the relationship between valve aeration and solids mass flow rate.

The significant results obtained during the Inclined L-valve testing include:

1. Slugging in the stand pipe was virtually eliminated.
2. Generally speaking higher stand pipe leg height and pressure drop was required when operating the bed at higher velocity and higher pressure drop. Figures A-14 and A-15 show this relationship.
3. The stand pipe leg height was not found to be affected by the amount of aeration introduced into the L-valve, i.e., the stand pipe leg height is self regulating. The leg height varies to overcome the burner pressure at the solids return loop.
4. The Inclined L-valve can operate with very little aeration as low as 30 SLPM (~ 1.1 scfm). Figure A-16 shows the relationship between valve aeration and solids flow. For the condition tested the mass flow rate increased until about 130 SLPM (~ 4.6 scfm). At flows higher than 130 SLPM (~ 4.6 scfm) the solids mass flow is not greatly affected by the aeration.
5. The stand pipe leg height never got above 60 inches under the best conditions.
6. The stand pipe pressure drop noticed for the Inclined L-valve was always higher than the Baffled L-valve for similar test conditions.

TABLE A-2

INCLINED L-VALVE DATA

PRESSURE TAP LOCATION					STAND PIPE SECTION $\triangle P$ ("W.C)						
					$\triangle P_1$	$\triangle P_2$	$\triangle P_3$	$\triangle P_4$	$\triangle P_5$		
ABOVE L-VALVE (INCHES)					9.5"	15.5"	27.5"	39.5"	51.5"		
DATE	TIME	BED VELOCITY FT/S	CYCLONE PRESSURE "W.C	AERATION TAP LOCATION AND FLOW (SLPM)						STAND PIPE LEG HEIGHT (INCHES)	BED PRESSURE DROP ("W.C)
10/3/83	12:05	8.9	23	#4, (100)	110	100	90	70	30	60	42
10/3/83	12:55	8.9	25	#4, (130)	110	94	80	70	25	64	42
10/3/83	14:10	9.0	24	#4, (130)	110	80	72	60	18	58	40
10/4/83	08:55	5.7	0	#4, (30)	30	20	7	0	0	30	28
10/4/83	09:10	7.8	5	#4, (30)	70	56	40	24	5	48	38
10/4/83	09:25	5.7	0	#4,(130)	60	48	30	16	3	48	44
10/4/83	11:00	9.9	26	#4,(130)	100	88	70	57	13	52	32
10/4/83	16:15	7.3	12	#4, (30)	80	62	40	34	8	48	34
10/4/83	16:40	10.2	20	#4, (30)	105	85	70	60	25	57	41
10/4/83	17:30	10.2	24	#4,(130)	100	90	70	64	17	54	37
10/4/83	17:40	10.2	24	#2,(170)	100	85	75	70	30	60	37

3.3 Conclusions

(1) Even though the Baffled L-valve and the Inclined L-valve were found to perform equally well, we recommend fabrication of stainless Inclined L-valve for hot testing. We feel that the Inclined L-valve is easier to fabricate and maintain in the final refractory-lined version of the L-valve.

(2) Even though the 5 ft stand pipe height was high enough to prevent solids from building up to the cyclone, we recommend a stand pipe height higher than 5 ft in order to minimize re-entrainment of cyclone collected fines.

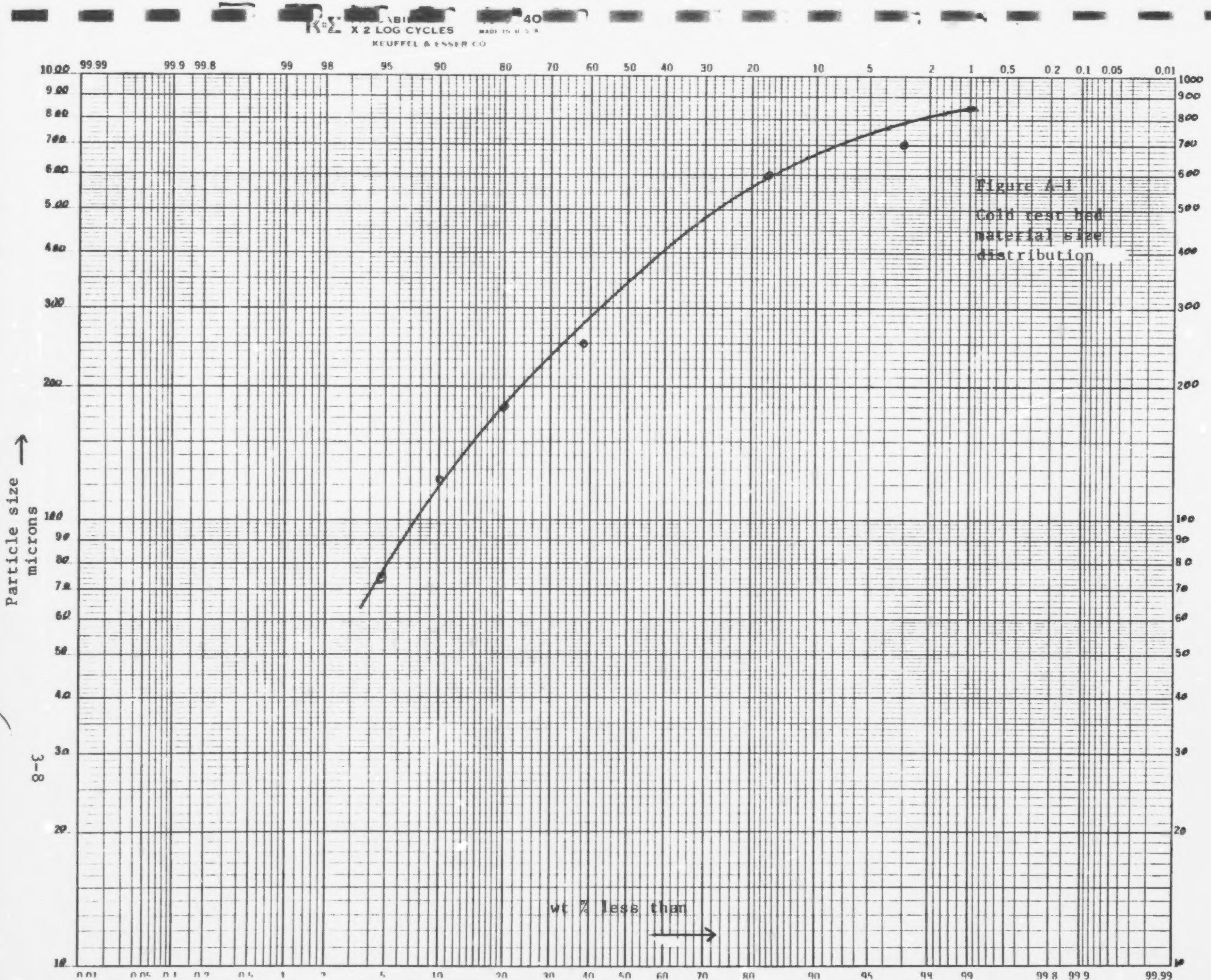


Figure A-1

Cold test bed material size distribution

FIGURE A-2 PLEXIGLAS L-VALVE CONFIGURATION

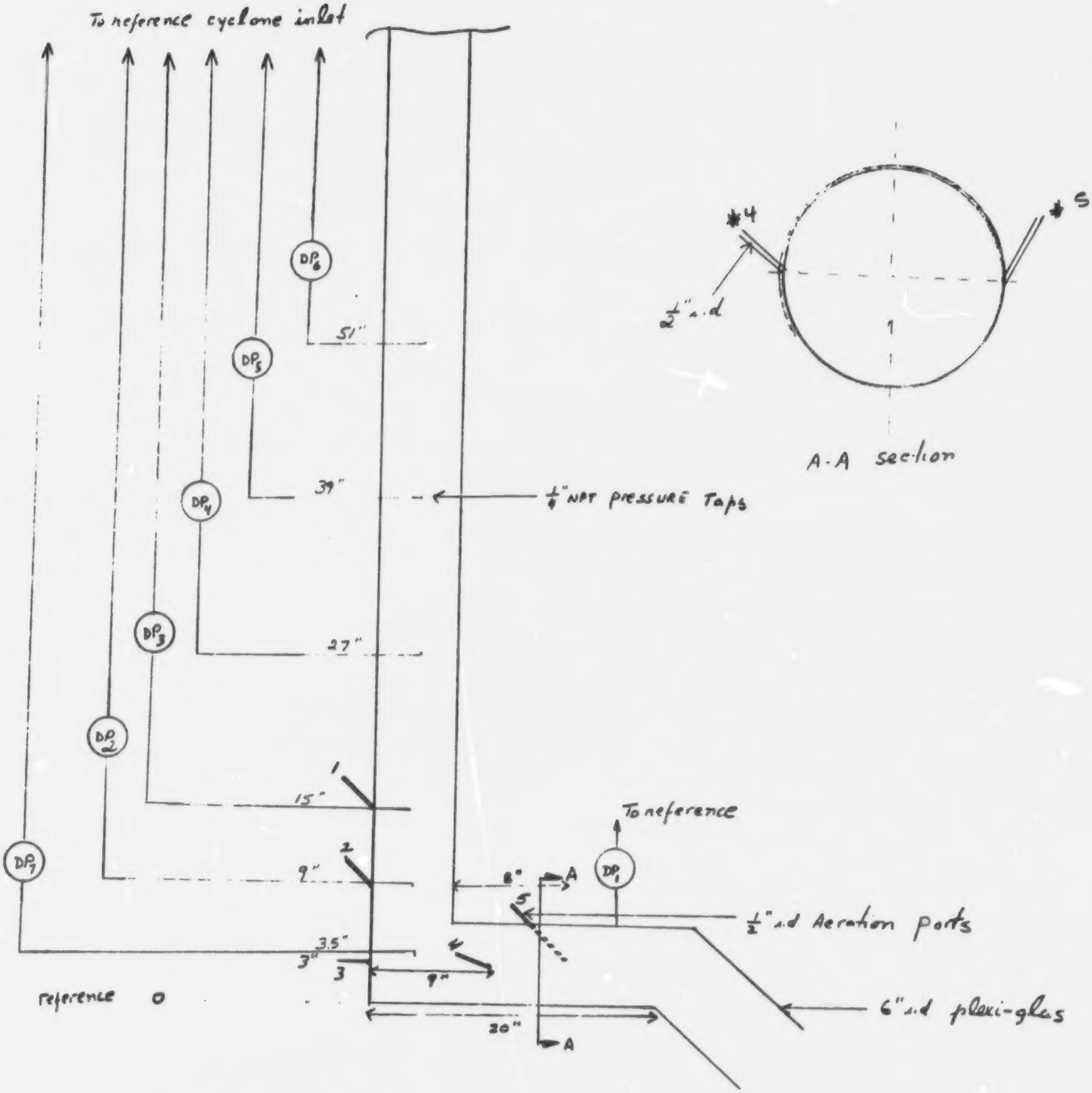

To reference cyclone inlet
DP6
51"
DP5
39"
DP4
¼" NPT pressure Taps
27"
DP3
DP2
15"
1
DP7
2
9"
To reference
DP1
8"
A
5
½" i.d Aeration ports
3.5"
3"
3
4
9"
reference 0
20"
A
6" i.d plexi-glas
#4
#5
½" i.d
A-A section

FIGURE A-3 PLEXIGLAS BAFFLED L-VALVE CONFIGURATION

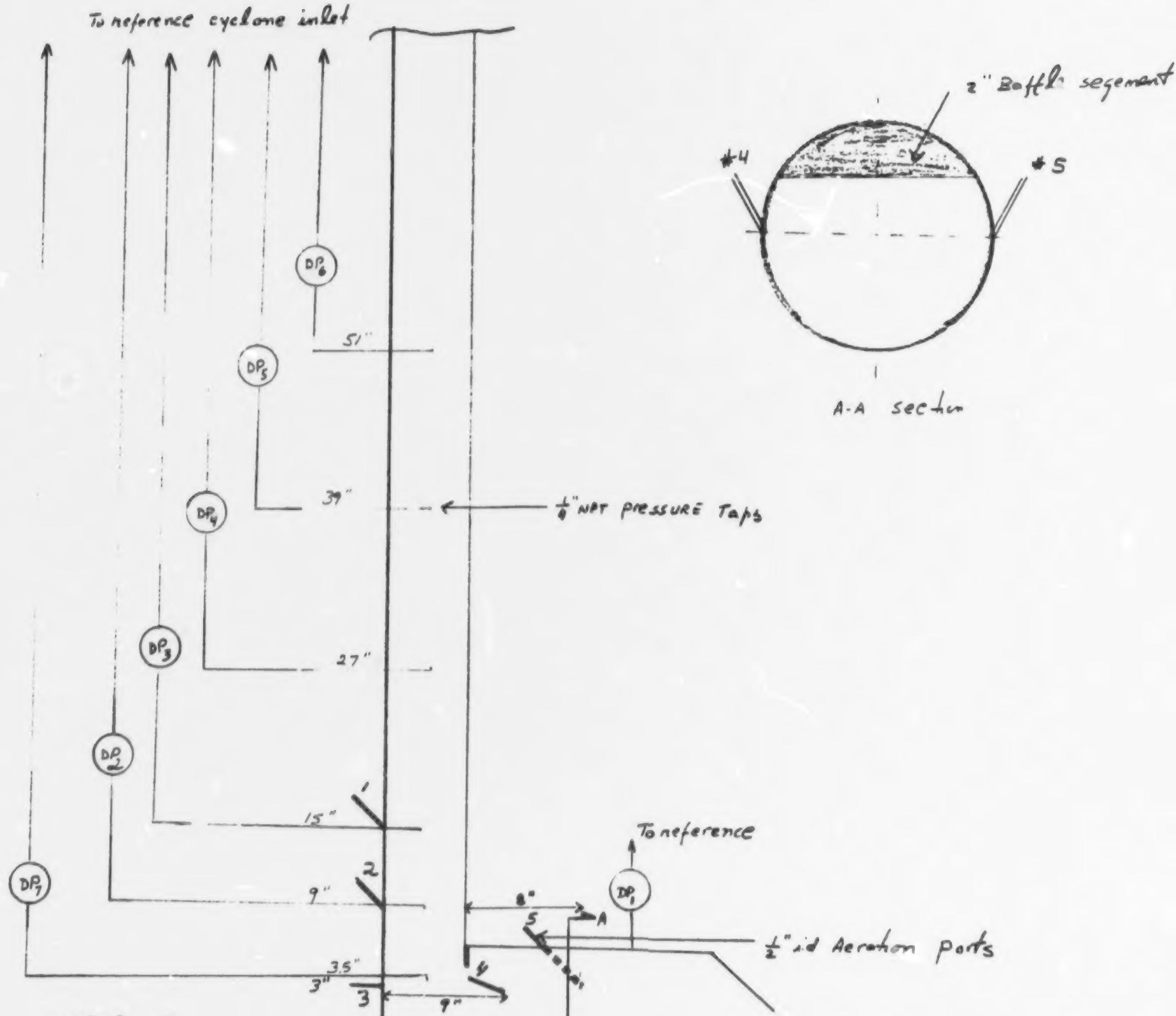
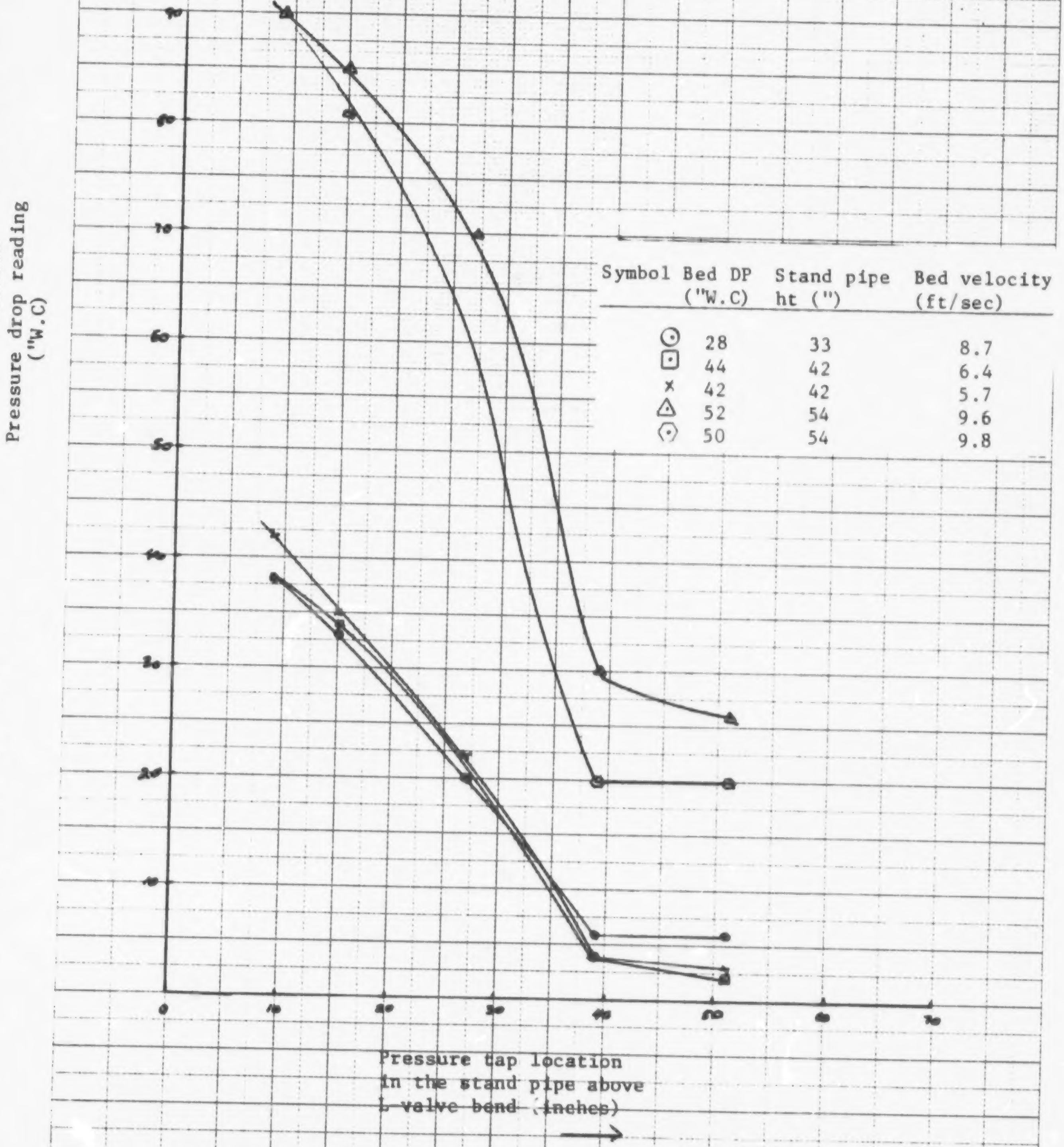

To reference cyclone inlet
2" Baffle segement
#4
#5
A-A section
DP6
51"
DP5
39"
1/8" NPT pressure Taps
DP4
27"
DP3
DP2
1
15"
To reference
2
9"
DP7
DP1
8"
A
5
1/2" i.d Aeration ports
3.5"
3"
4
3
9"
reference 0
6" i.d plexi-glas
20"
A

Figure A-4

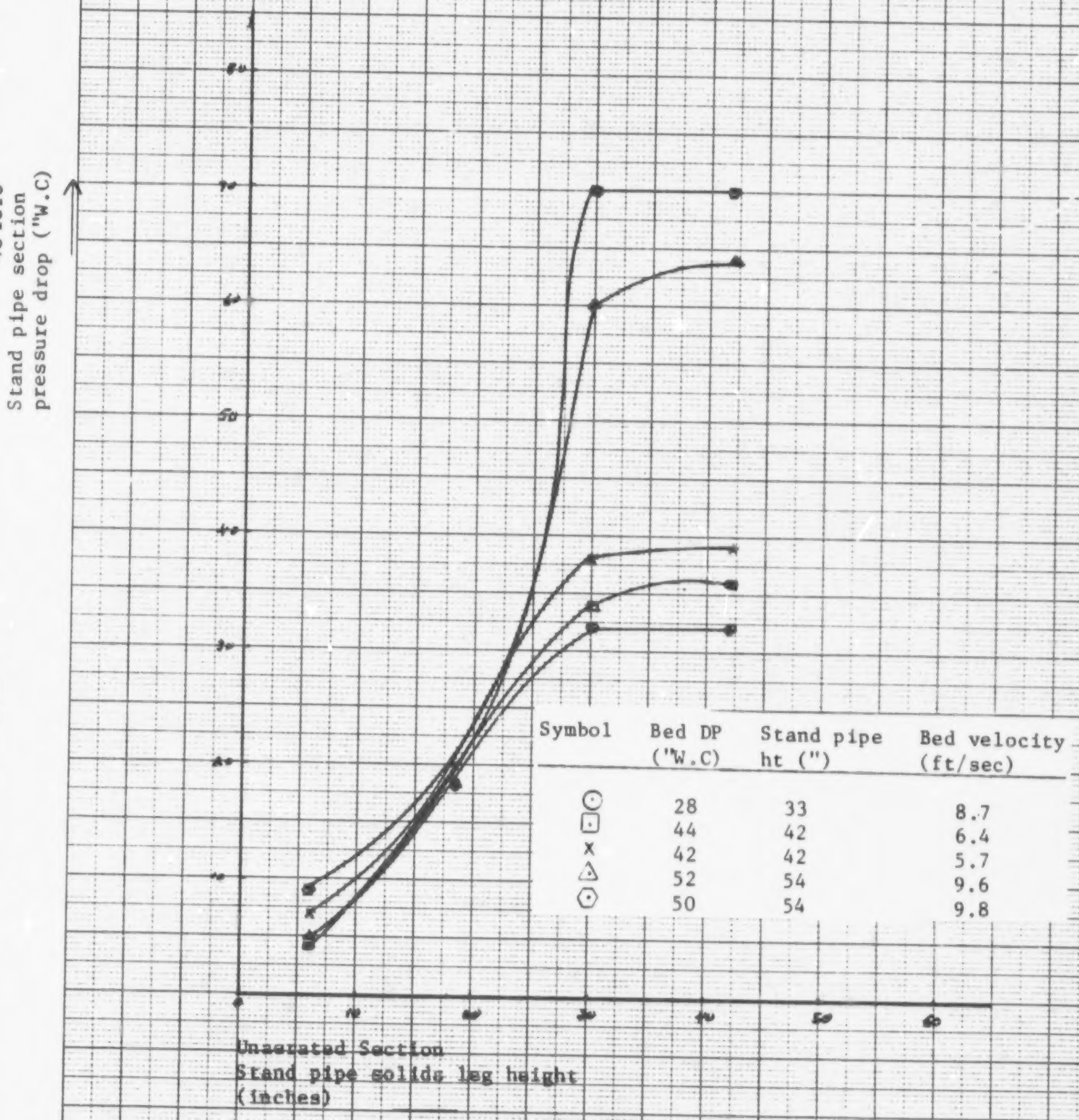
Baffled L-valve
Pressure drop vs Pressure tap
location in stand pipe



Symbol	Bed DP ("W.C)	Stand pipe ht (")	Bed velocity (ft/sec)
⊙	28	33	8.7
⊡	44	42	6.4
×	42	42	5.7
△	52	54	9.6
⊙	50	54	9.8

Figure A-5
Baffled L-valve

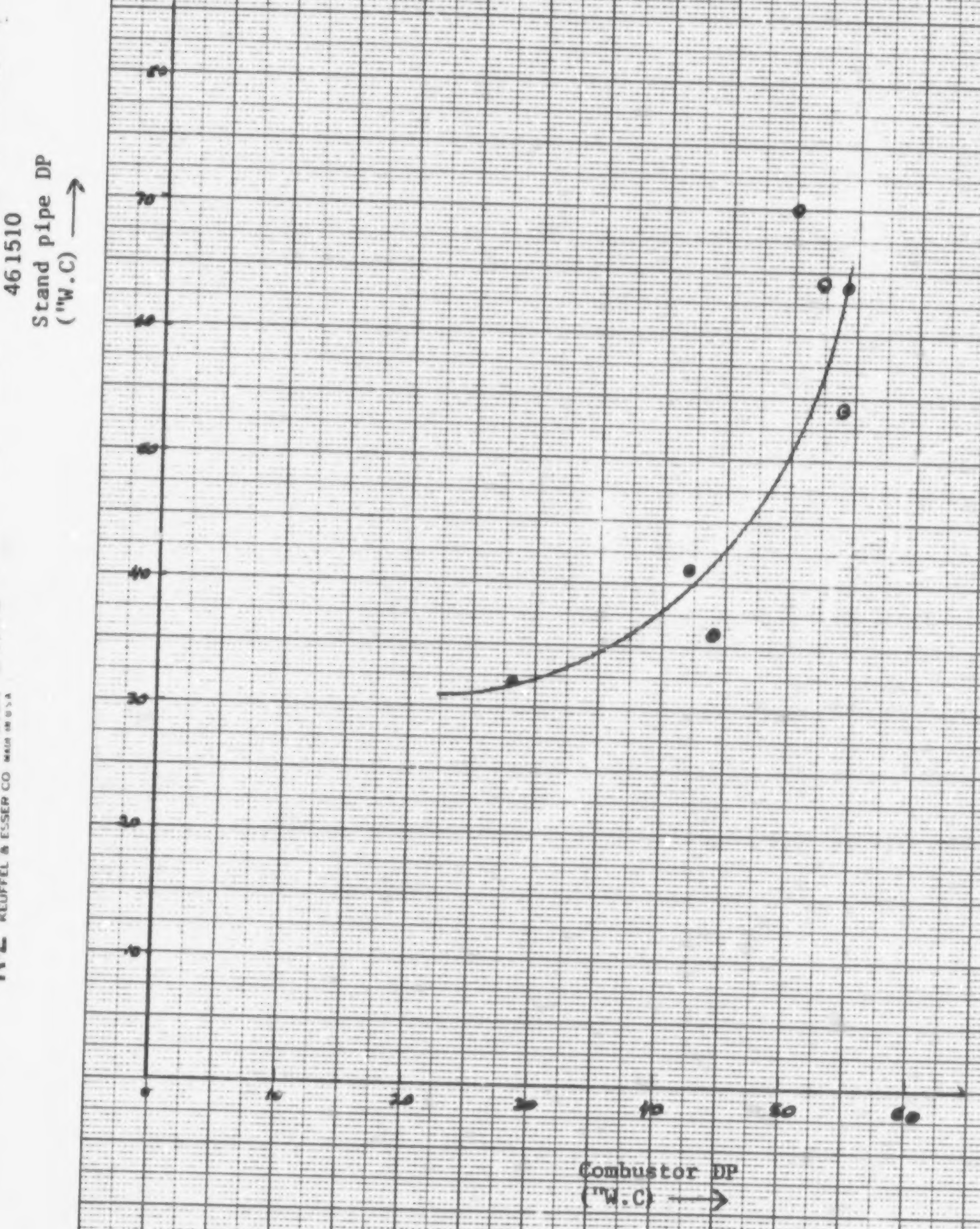
Stand pipe DP
vs
Stand pipe height



Symbol	Bed DP ("W.C)	Stand pipe ht (")	Bed velocity (ft/sec)
⊙	28	33	8.7
⊡	44	42	6.4
x	42	42	5.7
△	52	54	9.6
⬡	50	54	9.8

46 1510
K+E KEUFFEL & ESSER CO.

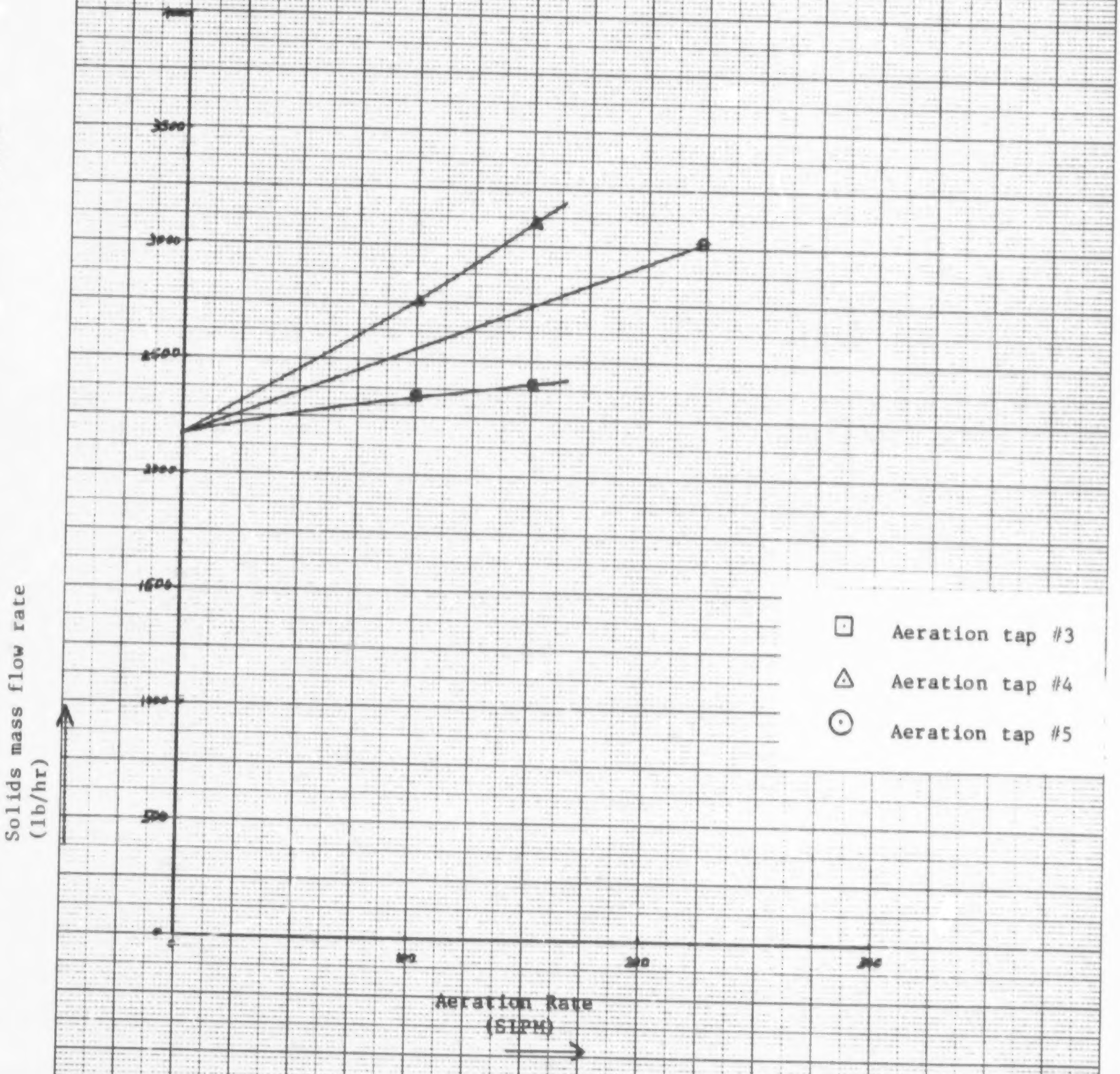
Figure A-6
Baffled L-valve
Combustor DP
vs
Stand pipe DP



K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure A-7

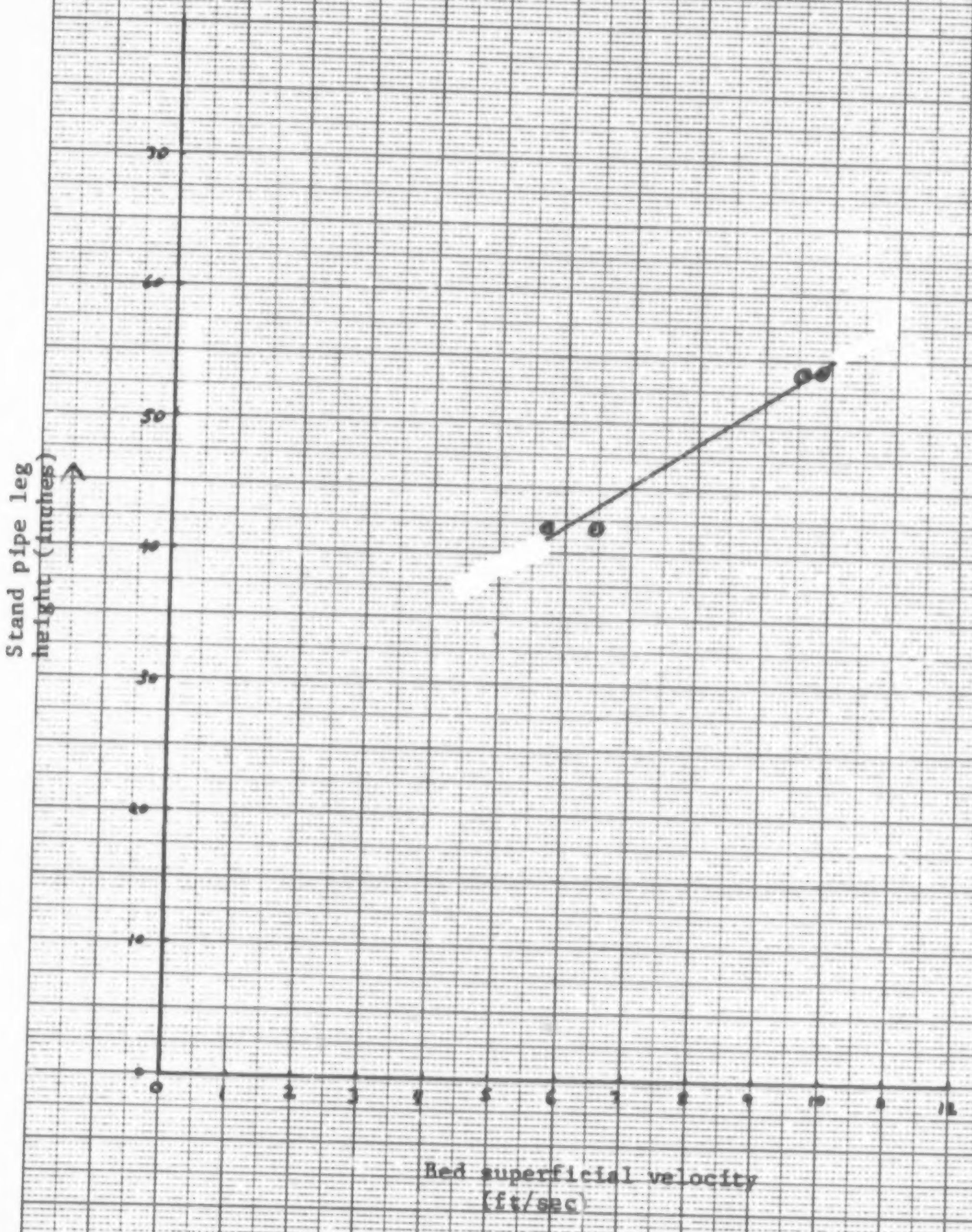
Baffled L-valve
valve aeration vs
solids mass flow rate



46 1510
K+E 10 X 10 TO THE CENTIMETER
KEUFFEL & ESSER CO.

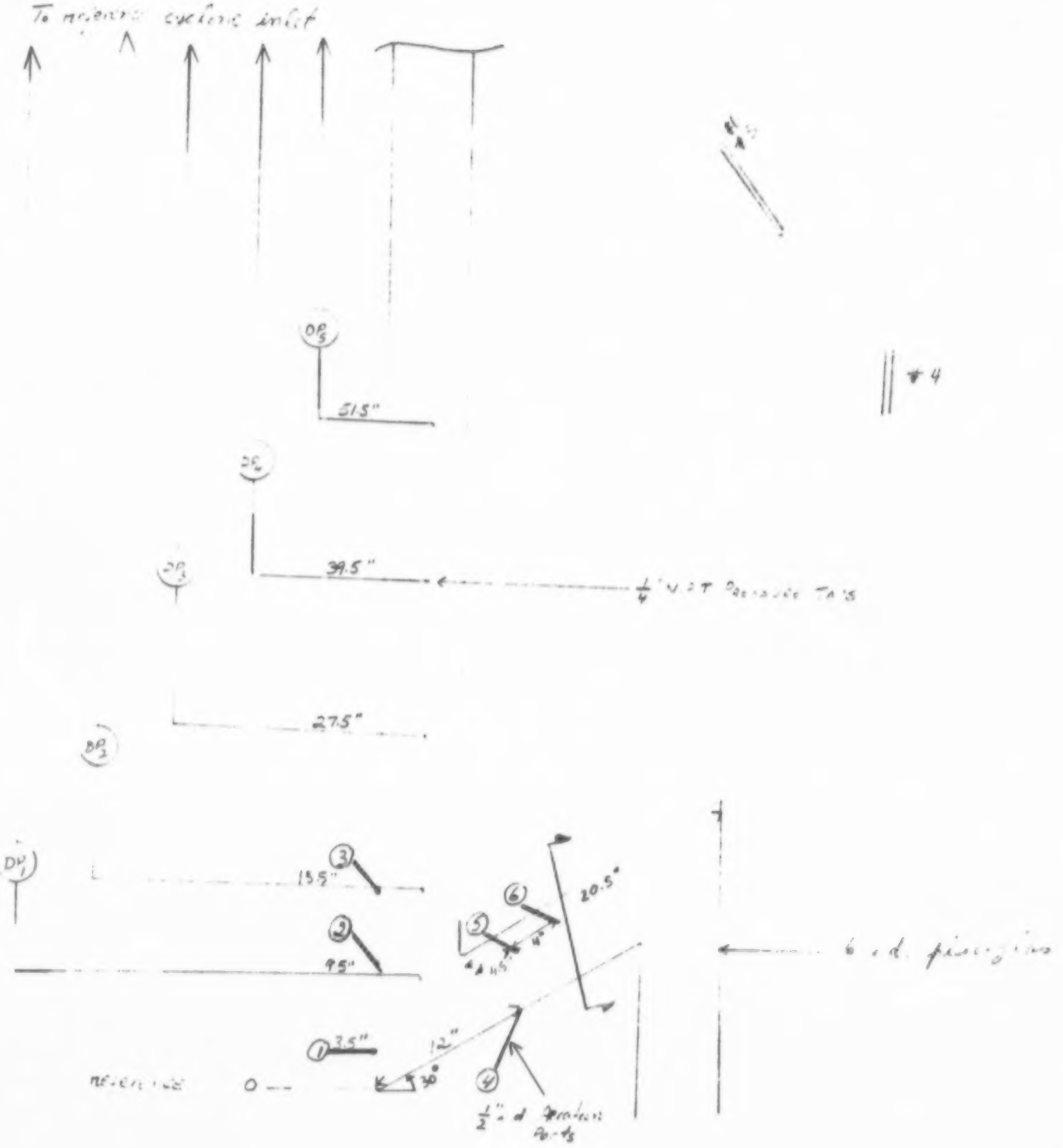
Figure A-8

Baffled L-valve
Bed superficial velocity
vs
Stand pipe leg height



K•E 10 X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.
461510

FIGURE A-9 PLEXIGLAS INCLINED L-VALVE CONFIGRATION


To [illegible] cyclonic inlet
DP5
51.5"
DP4
39.5"
1/4" NPT Pressure Taps
DP3
27.5"
DP2
#4
DP1
③
15.5"
②
9.5"
①
3.5"
⑤
⑥
4"
4.5"
20.5"
6" i.d. plexiglas
12"
30°
Reference
0
④
1/2" i.d. Aeration Ports

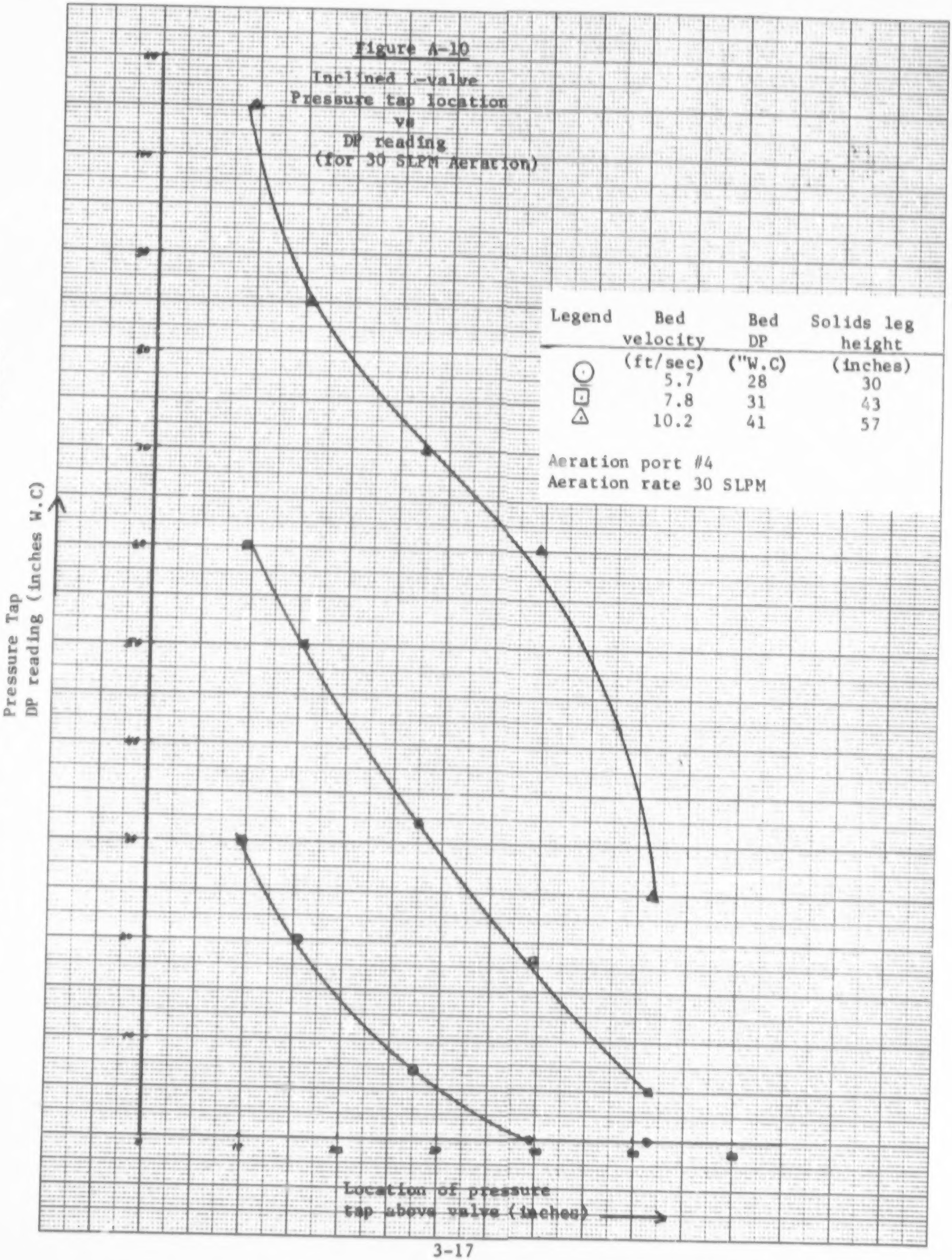


Figure A-10

Inclined L-valve
Pressure tap location
vs
DP reading
(for 30 SLPM Aeration)

46 1510
K+E 10 X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.

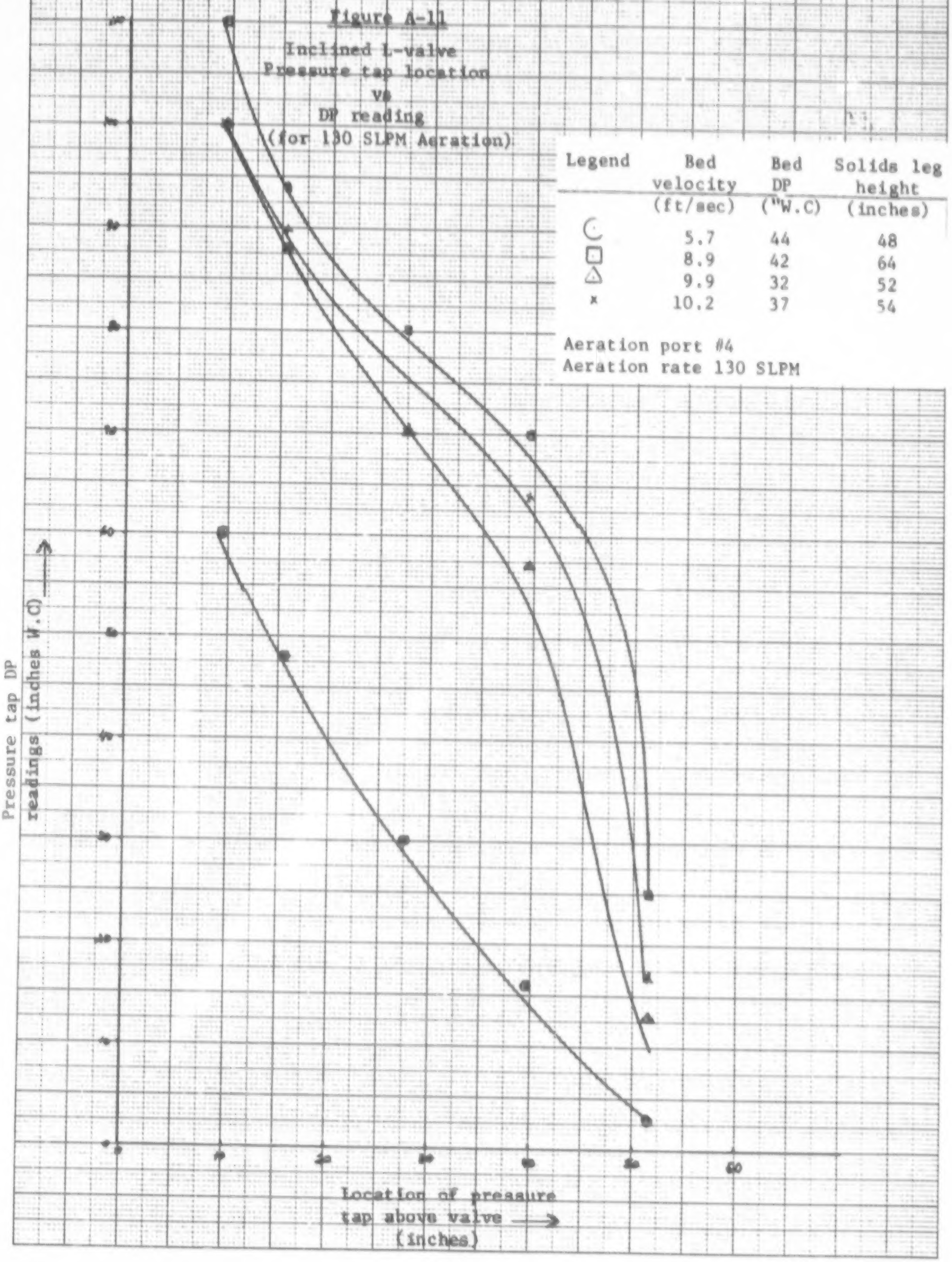


Figure A-11

Inclined L-valve
Pressure tap location
vs
DP reading
(for 130 SLPM Aeration)

Legend	Bed velocity (ft/sec)	Bed DP ("W.C)	Solids leg height (inches)
○	5.7	44	48
□	8.9	42	64
△	9.9	32	52
×	10.2	37	54

Aeration port #4
Aeration rate 130 SLPM

46 1510
K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.

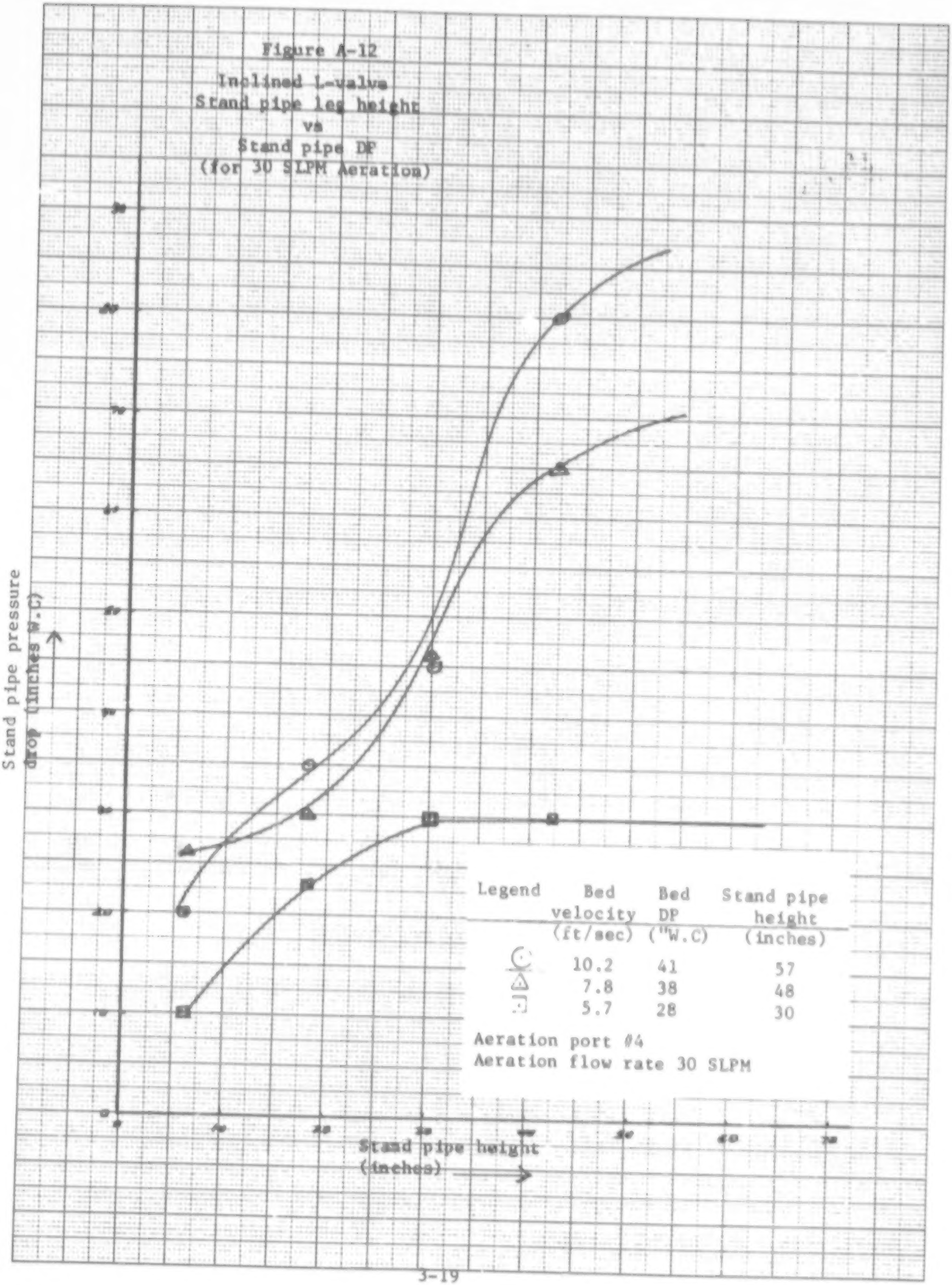


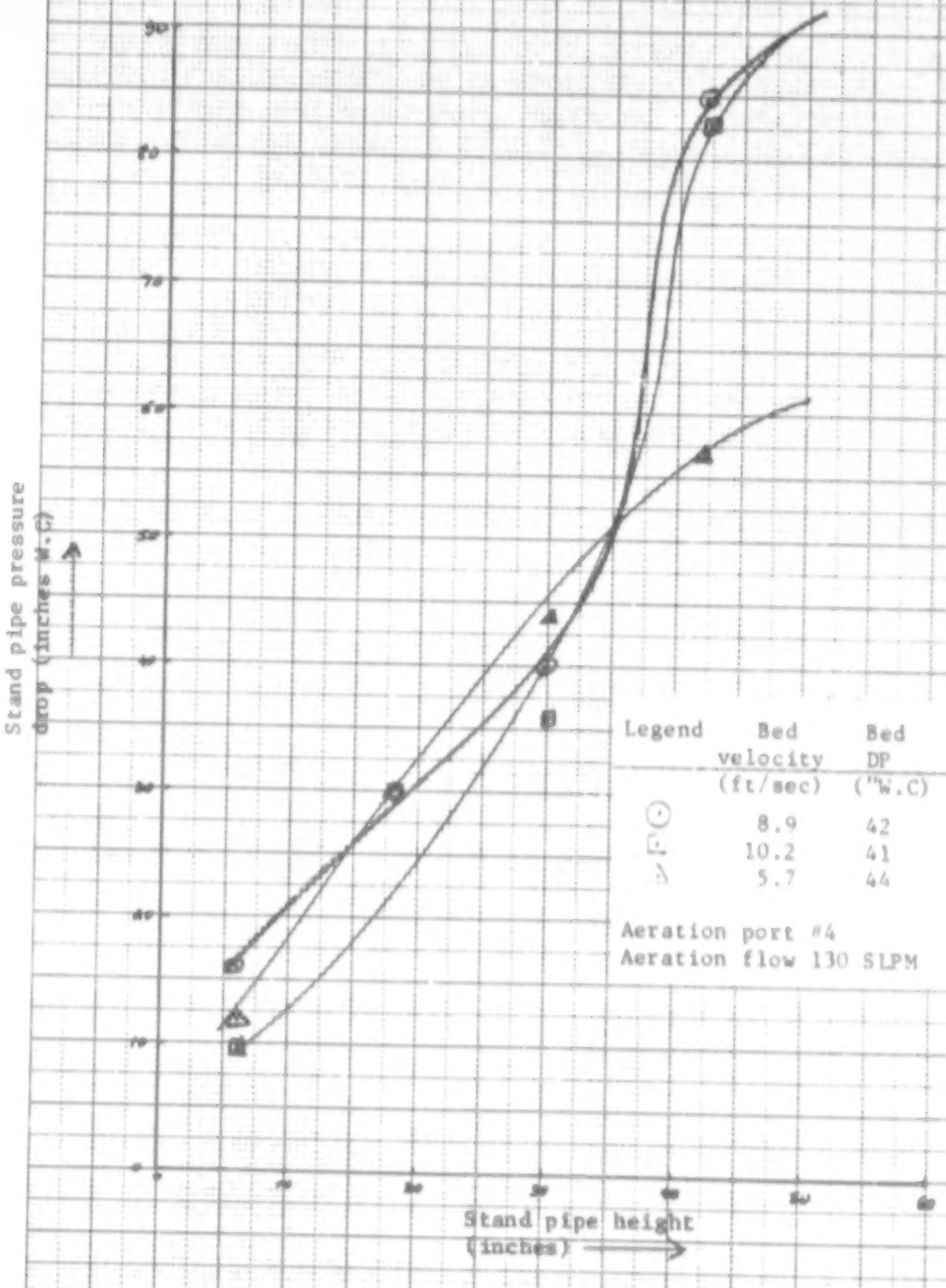
Figure A-12

Inclined L-valve
Stand pipe leg height
vs
Stand pipe DP
(for 30 SLPM Aeration)

46 1510
K·E 10 X 10 TO THE CENTIMETER 18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure A-13

Inclined L-valve
Stand pipe leg height
vs
Stand pipe DP
(for 130 SLPM Aeration)

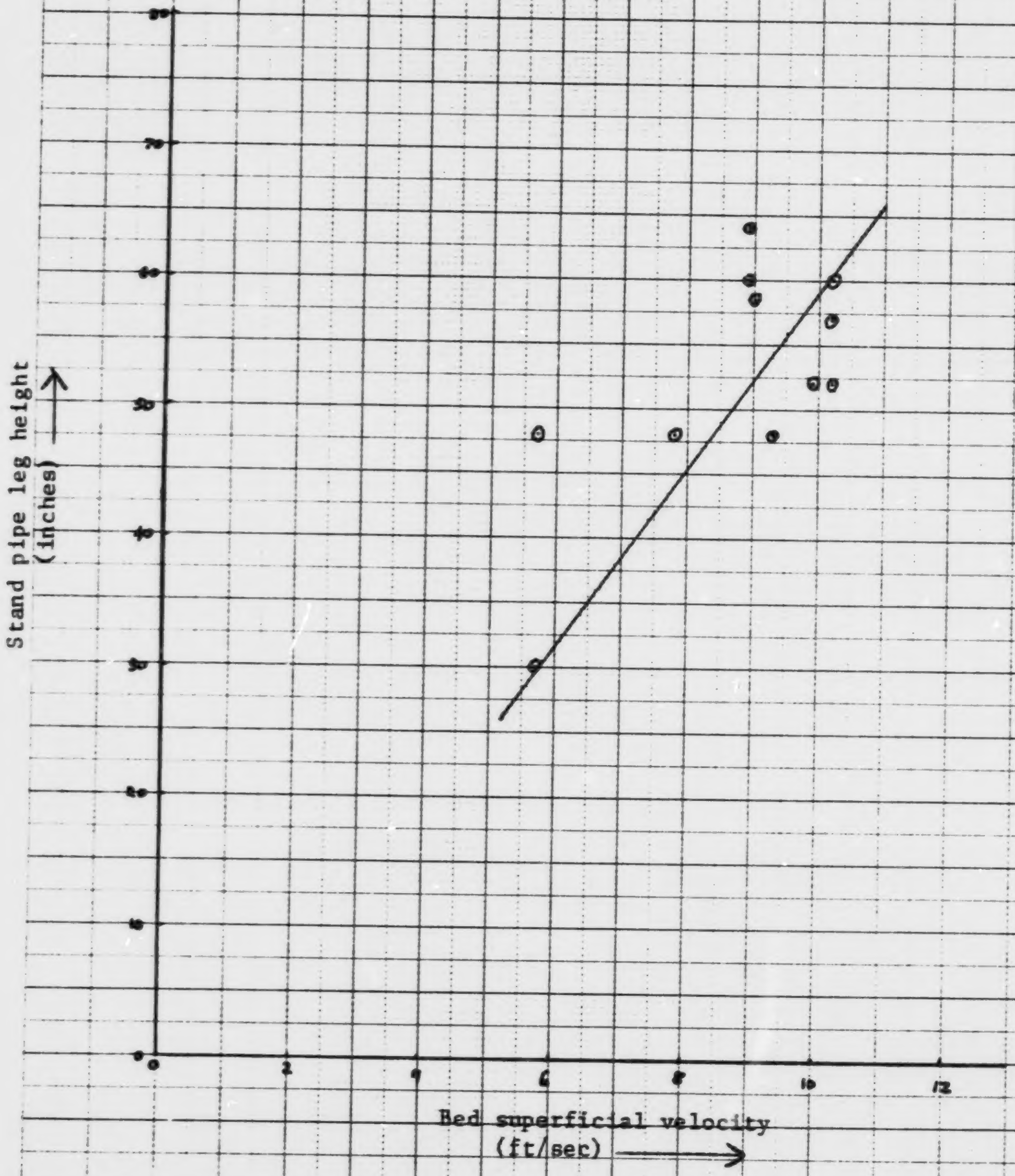


Legend	Bed velocity (ft/sec)	Bed DP ("W.C)	Stand pipe height (inches)
⊙	8.9	42	64
⊡	10.2	41	57
△	5.7	44	48

Aeration port #4
Aeration flow 130 SLPM

Figure A-14

Inclined L-valve
Bed superficial velocity
vs
Stand pipe height



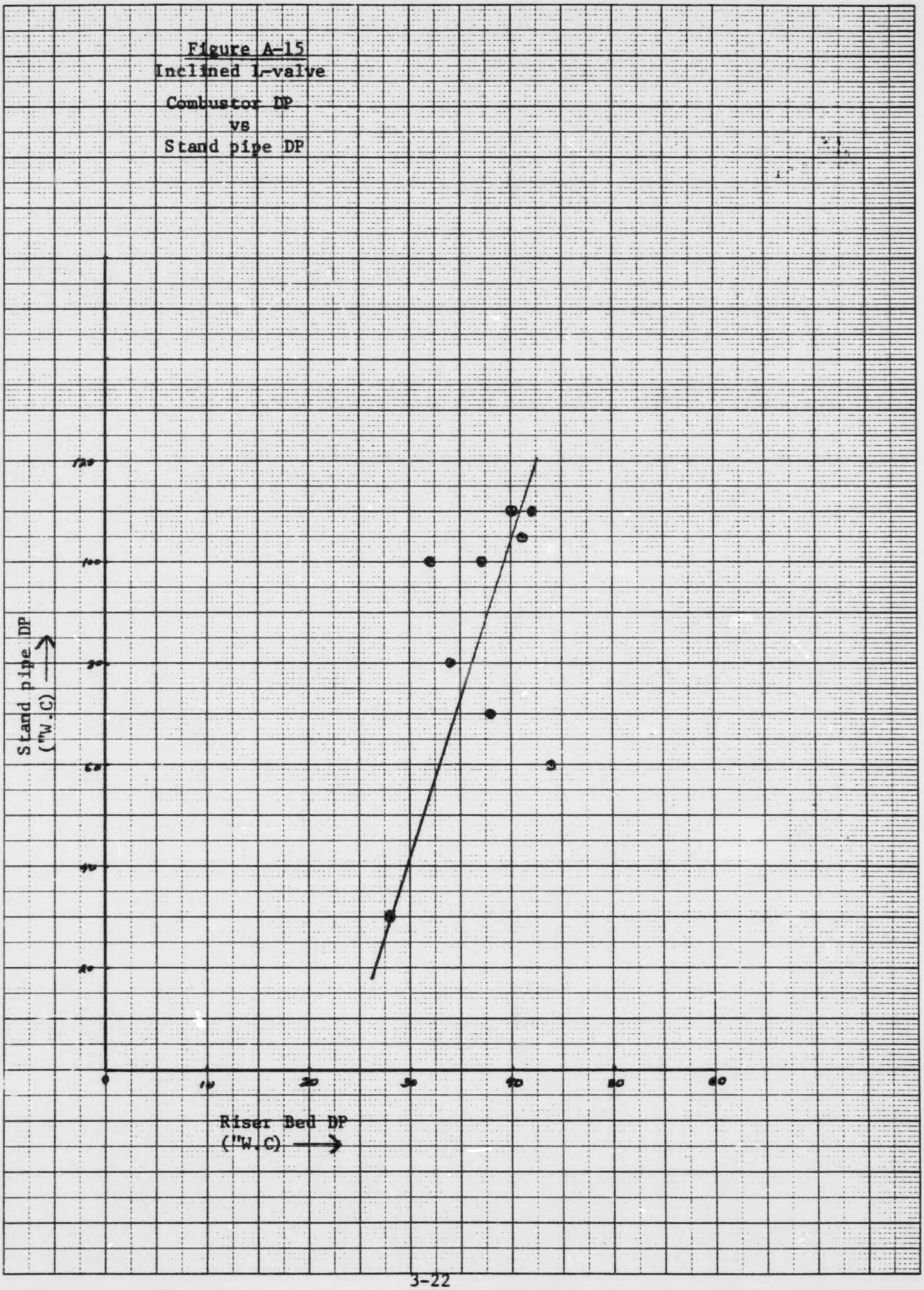


Figure A-15

Inclined L-valve

Combustor DP vs Stand pipe DP

K&E TO THE CENTIMETER KEUFFEL & ESSER CO MADE IN U.S.A. 461510

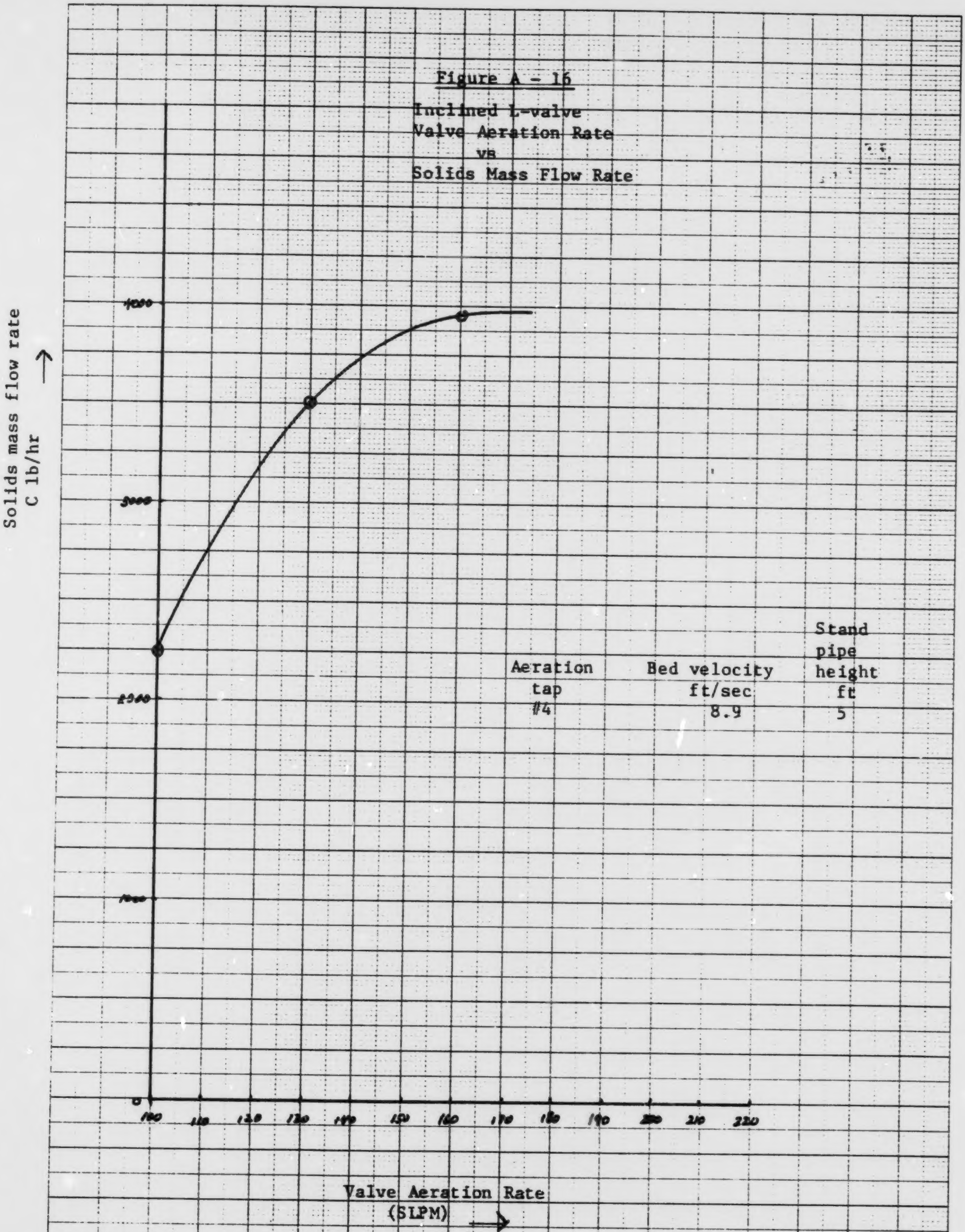


Figure A - 16

Inclined L-valve
Valve Aeration Rate
vs
Solids Mass Flow Rate

K+E 46 1510 KEUFFEL & ESSER CO. MADE IN U.S.A.

4.

HOT COMBUSTION TEST

4. Hot Combustion Test

4.1 Introduction

As determined in the cold test, the Inclined L-valve was recommended for a hot verification test. After approval from CANMET was obtained, a stainless steel version of the Inclined L-valve was fabricated and incorporated as a component of the 0.40 meter CFBC.

Ohio #6, a high sulfur bituminous coal, was selected as the fuel for the combustion test. Lowellville limestone was used as the sorbent.

4.2 Test Facilities

Figure B-1 is a schematic drawing of the combustor and accessory equipment used in the test.

The combustor has a 16 in. diameter and 25 ft. height. Table B-1 describes the circulating bed combustor system at GA Technologies. The elutriated solids are separated from the flue gas in a hot cyclone and reinjected into the bed using a nonmechanical seal. The flue gases exiting from the cyclone are cooled in the water-jacketed gas cooler and a shell-and-tube heat exchanger. The shell-and-tube heat exchanger is equipped with a bypass valve and tempering air to control its performance and degree of heat removal from the flue gases. The heat exchangers are followed by two baghouses which separate the fly ash not collected by the cylcone from the flue gases.

The coal and limestone are pneumatically transported into two separate bunkers and feed pneumatically at the bottom of the combustor. The coal and limestone feed rates are controlled using feed rotary valves. The bottom bed ash, consisting of coarse bed materials, is removed periodically from the bottom of the combustor and pneumatically conveyed to a surge bunker for sampling and disposal.

The combustion air is injected at two different levels. The primary air consists of (1) pneumatic air for the injection of coal and limestone and, (2) the fluidizing air injected at the bottom of the combustor through air nozzles in the distributor plate. The secondary air is injected at a higher elevation in the combustor.

GA Technologies

TABLE B-1: CIRCULATING BED COMBUSTOR SYSTEM AT G A TECHNOLOGIES INC.

THERMAL RATING :	UP TO 2,000,000 BTU/HR
SIZE :	16-IN. DIAMETER X 25-FT. HEIGHT
PRESSURE RATING :	UP TO 3 PSIG AT GAS DISTRIBUTOR
FLUIDIZATION GAS VELOCITY :	4 TO 20 FT/SEC
COMBUSTOR TEMPERATURE :	UP TO 1800 DEGREES F
CYCLONE :	16-IN. DIAMETER
FLUE GAS CLEANUP :	FABRIC FILTER BAGHOUSE , SINTERED-METAL FILTERS , OR WET SCRUBBER
ASH RECYCLE CAPABILITIES :	INFINITE VARIATION ON CYCLONE AND BAGHOUSE RECYCLE
FLUE GAS ANALYSIS :	CONTINUOUS ON-LINE ANALYSIS OF O_2 , SO_2 , CO , NO_x , CO_2
INSTRUMENTATION :	TEMPERATURES , PRESSURES , GAS COMPOSITIONS , SOLIDS AND GAS FLOW RATES (ALL TRACEABLE TO NBS)
DATA ACQUISITION :	COMPUTER-BASED DATA ACQUISITION SYSTEM AUTOMATICALLY RECORDS MAJOR PROCESS VARIABLES AT 1-MINUTE INTERVALS
ON-LINE CALCULATIONS :	UNIT PERFORMANCE CALCULATED AND UPDATED EVERY 30 SEC DISPLAYED ON COLOR CRT AND LOGGED ON LINE PRINTER
POST-RUN DATA ANALYSIS :	COMPUTERIZED MATERIAL BALANCE , UNIT PERFORMANCE , COMPUTER PLOTS OF DATA VS TIME
HEAT TRANSFER SURFACE :	IN-BED WATER-COOLED TUBES OR EXTERNAL AIR-COOLED JACKET

4.3 Control, Instrumentation, and Data Acquisition

Extensive use is made of computer-based data acquisition, process control, and data analysis/reporting equipment. Instrumentation includes thermocouples, fluidizing air flowmeters, pressure transmitters, solids level sensors, rotary feeder speed indicators, water flowmeters, and off-gas analysis. These instruments are calibrated on a regular schedule with standards traceable to the U.S. National Bureau of Standards.

The control room houses a main control panel (Fig. B-2), a control center (Fig. B-3), and a results/program development center (Fig. B-4). Necessary software and techniques have been developed to interface the control center equipment into an automated research tool.

A Diogenes process control computer performs basic three-mode control. Process variables are recorded on strip charts. All on/off functions and sequencing are controlled by the operator. A Hewlett Packard 9825A supervisory computer and peripherals perform data acquisition, data storage, results analysis, and graphic plots. Temperature measurements are taken from the thermocouple directly in millivolts, and other process variables are measured directly from their respective transmitters by a programmable digital voltmeter. The human interface of interpreting data from strip charts is thus eliminated. A permanent record of the experiment is preserved on a magnetic disc. The combustor is automated so that a single operator can safely control it. Major control loops control bed and vessel temperature, excess air, Ca/S ratio, coal feed rate, ash recycle rate, and superficial gas velocity. Color graphics displays serve to inform the operator of process conditions. All critical information is presented on a process diagram with color changes for alarm conditions. A process operating summary in tabular format appears on a second display. The supervisory computer updates the displays every 30 sec. An event logger records all process alarm and setpoint changes.

4.4 Sampling and Analysis

Sampling

Coal and limestone samples were taken from each drum. The coal and limestone chemical analyses are given in Tables B-2 and B-3. The limestone size analysis performed with sieve screens is given in Figure B-5.

The samples were taken after the elapse of sufficient time at the steady state conditions. These samples were bed ash and filter (Baghouse) ash. Total carbon and carbonate carbon were determined in the ash samples. The amount of unburned carbon in the ash is determined by the difference between the total carbon and the carbonate content. Size distribution of the fly ash sample were determined by Leeds and Northrup instruments using laser beam scattering technique. Figure B-6 shows the fly ash size distribution.

TABLE B-2

CHARACTERISTICS OF COAL USED IN THE HOT TEST

Coal Type	Ohio #6	
Proximate Analysis (wt % as-received)		
Moisture		4.5
Ash		13.0
Volatile		40.3
Fixed Carbon		42.2
HHV (Btu/lb)	Wet	11,960
	Dry	12,520
Ultimate Analysis (wt %)		
Carbon		66.40
Hydrogen		5.01
Nitrogen		1.30
Chlorine		-
Sulfur		3.70
Ash		13.00
Oxygen		10.59
Size		-1/4" x 0"

TABLE B-3

CHARACTERISTICS OF LIMESTONE USED IN THE HOT TEST

Type of limestone	Lowelville
Chemical Analysis (wt %)	
$CaCO_3$	90.67
Mg CO_3	1.19
Moisture	0.01
Other	8.13

Off gas samples are continuously monitored for SO_2, CO_2, CO, O_2 and NO_x. The off gas analysis equipment is described in Table B-4. Samples are analyzed on dry basis.

Chemical Analysis

(1) Total Carbon: Total carbon in the fly ash and bed ash are determined using a LECO IR12 carbon determinator. Total carbon includes both unburned carbon (char) and carbonate carbon.

(2) Fly ash and bed ash carbonate is decomposed by hydrochloric acid. The CO_2 which is liberated is captured by an ascarite sorbent trap. The amount of carbonate in the ash is determined by dividing the weight change in the sorbent trap by the initial sample weight. The percent carbonate is a measure of uncalcined limestone in the ash and is subtracted from the percent loss on ignition to determine the percent unburned (char) in the ash.

(3) Moisture Content: The moisture content of the as-fed fuels and limestone was determined. A sample of the limestone and each fuel was heated to 105°F for 24 hours. The moisture content was determined by dividing the sample weight change by the initial sample weight.

4.5 Test Description

The Inclined L-valve configuration tested in combustion mode is shown in Figure B-7. The valve tested is made out of 6" i.d stainless material. It had 5 aeration ports and 5 pressure taps.

Test run #1 was started on October 12, 1983, at 11:00. Sand-30 mesh was used as start-up bed material. Coal feeding was started at 19:40. Steady state was achieved at 21:00. The steady state combustion continued until October 13, 1983, 13:00 when the limestone and coal feed line was plugged. The burner had to be cooled down in order to unplug the transport system. The bed was transported into the burner at 17:00. The bed heat up was going on using Induction Coil until about 19:15 when the MG (motor generator) powering the Induction Coil tripped. The burner had to be shut down for the night. After trouble shooting the MG the burner was loaded with the bed material at 13:30 October 14, 1983, and heated up. Coal feeding was started at 18:10. The burner was shut down at 20:15 because of the stand pipe bellows expansion joint failure.

On October 28, 1983, test run #2 was made and some L-valve performance data was collected at velocities ranging from 8.7 to 16.0 ft/sec. Even though the test was conducted while burning coal the overall combustor performance data such as combustion efficiency and sulfur capture could not be determined because of the short test time.

TABLE B-4

OFF-GAS ANALYZER DESCRIPTIONS

CO: Beckman Model 864 Non-Dispersive Infrared Analyzer

Range: 0 to 1000 ppm
0 to 5000 ppm

Precision: 1% of full scale

SO_2: Beckman Model 865 Non-Dispersive Infrared Analyzer

Range: 0 to 500 ppm
0 to 2500 ppm

Precision: 1% of full scale

NO_X: Beckman Model 951A NO/NO_X Analyzer

Range: Selectable full-scale range of 10, 25, 100, 250, 1000, 2500, and 10,000 ppm

Precision: 0.5% of full scale

CO_2: Lira Model 3000 Infrared Analyzer

Range: 0 to 25%

O_2: Beckman Model F3 Oxygen Analyzer

Range: 0 to 100%
0 to 50%
0 to 20%

Precision: 1% of full scale

Run #3 was made on December 14 - 15, 1983, more L-valve performance data were collected while burning hazardous potlining waste in the 40 cm burner. During this time the L-valve performance data was collected for about 12 hours of steady state operation.

4.6 Test Results

The L-valve stand pipe pressure drop readings and other process parameters were recorded periodically both during coal and potlining burn test.

Tables B-5, B-6 and B-7 show the pressure drop readings recorded during hot test runs #1, #2 and #3 respectively. Figures B-8 through B-15 show the results graphically.

Table B-8 gives the combustor performance summary during coal combustion (hot test run #1). Figures B-16 through B-28 show process conditions in hot test run #1 while figures B-29 through B-33 show process conditions for hot test run #3.

Figures B-10 and B-15 show the relationship between stand pipe pressure drop and stand pipe leg height for test runs #1 and #3. These two sets of curves show relatively reproducible performance characteristics of the Inclined L-valve. Such a curve then can be utilized to control L-valve performance.

TABLE B-5

INCLINED L-VALVE HOT TEST Run #1

10/12 - 10/14, 1983

Date	10/12	10/12	10/12	10/12	10/12	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/14
Time	19:30	20:15	21:00	22:00	22:50	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	19:00
Bed DP ("W.C)	30	20	20	23	20	19	20	45	45	43	40	40	40	40	40	50	40	40	40
Cyclone P P ("W.C)	15	20	25	15	10	10	9	12	11	11	13	13	13	15	15	17	15	15	35
Bed Velocity (ft/s)	10.3	11.4	11.0	8.7	8.2	8.3	7.8	8.6	9.0	8.7	8.9	8.9	9.0	9.2	9.1	10.1	9.7	9.7	10.4
Bottom Seal DP, DP_1 ("W.C)	40	40	40	35	32	35	32	35	42	42	42	45	44	45	45	45	45	45	45
Stand Pipe Lower DP, DP_2 ("W.C)	-*	15	16	19	12	9	14	20	16	17	16	17	16	16	16	16	17	18	17
Mid Stand Pipe DP, DP_3 ("W.C)	-*	7	9	10	8	5	5	5	6	6	6	4	4	4	4	4	5	4	4
Stand Pipe Upper DP, DP_4 ("W.C)	3	6	7	5	3	4	4	4	4	4	4	4	4	3	4	4	3	3	4

*DP tap was plugged.

TABLE B-5

INCLINED L-VALVE HOT TEST Run #1

10/12 - 10/14, 1983

(Continued)

Date	10/12	10/12	10/12	10/12	10/12	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/13	10/14
Time	19:30	20:15	21:00	22:00	22:50	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	19:00
Loop Seal Crossover DP, DP_5 ("W.C)	25	30	33	20	16	30	23	25	20	18	22	15	15	16	17	18	18	18	15
L-Valve Aeration (slpm)	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
scfm (scfm)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Aeration port air flow rate settings	(slpm)
#1	40
#2	70
#3	80
#4	50
#5	40

TABLE B-6
INCLINED L-VALVE HOT TEST
Run #2

Date	10/28	10/28	10/28	10/28	10/28	10/28	10/28	10/28
Time	13:30	14:50	16:00	17:00	18:00	18:45	19:10	19:25
Bed DP ("W.C)	33	30	30	30	30	33	33	35
Cyclone P ("W.C)	3	8	10	13	15	25	25	30
Bed Velocity (ft/s)	3.8	8.7	8.7	10.0	11.5	12.0	15.0	16.0
Bottom Seal DP, DP_1 ("W.C)	50	40	30	35	40	40	40	40
Stand Pipe Lower DP, DP_2 ("W.C)	18	17	15	16	18	18	18	18
Mid Stand Pipe DP, DP_3 ("W.C)	2	2	1	1	2	2	2	2
Stand Pipe Upper DP, DP_4 ("W.C)	1	1	1	1	0	1	1	1
Loop Seal Crossover DP, DP_5 ("W.C)	40	20	18	20	28	28	28	28
L-Valve Aeration (slpm)	275	275	275	275	275	275	275	275
(scfm)	10	10	10	10	10	10	10	10

Aeration port air flow readings (slpm)

#1	40
#2	70
#3	80
#4	50
#5	40

TABLE B-7
MM TEST L-VALVE PERFORMANCE Hot Test Run #3
12/14 - 12/15, 1983

Date	12/14	12/14	12/14	12/14	12/14	12/15	12/15	12/15	12/15	12/15	12/15	12/15
Time	19:32	20:16	21:09	22:27	23:000	00:07	01:00	02:00	03:00	04:00	05:00	07:00
Bed DP ("W.C)	40-60	40-60	40-60	40-60	40-60	40-60	40-60	50-60	50-60	50-65	50-65	50-60
Cyclone P ("W.C)	15	15	15	35	30	32	31	31	31	31	33	8
Bed Velocity (ft/s)	12.7	13.0	13.4	13.4	12.5	12.9	12.0	12.4	12.5	12.7	12.0	4.4
Bottom Seal DP, DP$_1$ ("W.C)	50	50	40	43	40	40	45	40	45	40	45	30
Stand Pipe Lower DP, DP$_2$ ("W.C)	25	25	15	15	16	16	19	17	20	18	N/A	N/A
Mid Stand Pipe DP, DP$_3$ ("W.C)	14	14	15	13	13	13	12	11	9	7	6	4
Stand Pipe Upper DP, DP$_4$ ("W.C)	14	14	15	13	13	13	12	11	9	7	6	4

TABLE B-7
MM TEST L-VALVE PERFORMANCE Hot Test Run #3
12/14 - 12/15, 1983
(Continued)

Date	12/14	12/14	12/14	12/14	12/14	12/15	12/15	12/15	12/15	12/15	12/15	12/15
Time	19:32	20:16	21:09	22:27	23:000	00:07	01:00	02:00	03:00	04:00	05:00	07:00
Loop Seal Crossover DP, DP_5 ("W.C)	N/A	N/A	N/A	35	35	35	35	35	36	34	40	26
Total Aeration L-Valve (slpm)	100	185	185	185	185	185	185	185	185	185	185	185
scfm	3.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53
Purge #1 slpm	0	0	0	0	0	0	0	0	0	0	0	0
Purge #2 slpm	20	20	20	20	20	20	20	20	20	20	20	20
Purge #3 slpm	65	100	100	100	100	100	100	100	100	100	100	100
Purge #4 slpm	15	65	65	65	65	65	65	65	65	65	65	65
Purge #5 slpm	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B-8

CANMET -L-VALVE TEST RUN #1

DATE	10/13/83
RUN TIME	2600-3600 HOURS

PERFORMANCE SUMMARY

BED TEMPERATURE		1550 °F
SUPERFICIAL VELOCITY		
INLET AIR BASIS		8.5 FT/SEC
FLUE GAS BASIS		9.0 FT/SEC
EXCESS AIR		34.9 PCT
CALCIUM/SULFUR RATIO*		2.87
SULFUR RETENTION		89.64 PCT
CARBON CONVERSION*		90.53 PCT
COMBUSTION EFFICIENCY*		92.62 PCT
FLUE GAS ANALYSIS		
O2	5.6 PCT	
SO2	287 PPM	0.66 LB/MBTU
NOX	237 PPM	0.39 LB/MBTU
CO	706 PPM	0.71 LB/MBTU
H/C	0 PPM	
CO2	18.4 PCT	
SO3	0 PPM	
MATERIAL FLOWS		
FUEL FEED		80.0 LB/HR
LIMESTONE FEED		28.0 LB/HR
FILTER ASH DRAIN		24.5 LB/HR
BED ASH DRAIN		0.0 LB/HR
FILTER ASH RECYCLE		0.0 LB/HR

CHEMICAL ANALYSIS (WT. PERCENT DRY)

OHIO #6 COAL

C	H	S	N	O	ASH	H2O	BTU/LB
66.4	5.0	3.7	1.3	10.6	13.0	4.5	12520

	LOI	CO2	CAO	SO3	BTU/LB
FILTER ASH	28.5	8.9	0.0	0.0	2764
BED ASH	0.0	0.0	0.0	0.0	

*See Page 4-16

4.7 Conclusion

The L-valve performance data collected clearly show the Inclined L-valve design performed well for the conditions tested. The most significant results include:

1. The stand pipe leg height did not rise higher than 6 ft.
2. The stand pipe DP did not go higher than 50 "W.C.
3. Stand pipe aeration as low as 6.5 scfm was good enough to result in solids circulation.
4. The stand pipe height and pressure drop increased or decreased in response to the combustor pressure drop.
5. The amount of aeration did not affect the stand pipe height or the L-valve performance for the aeration flows tested (6.5 to 10 scfm).

6.* Coal combustion efficiency of 92.62% was achieved when burning Ohio #6 coal.

7.* Sulfur retention of 90% was achieved with Ca/S molar ratio of 2.87 while using Lowellville limestone.

8. The stand pipe section pressure drop readings did not exhibit wide fluctuation. This behavior was noticed during the cold model test only when there was no gas bypassing or slugging in the stand pipe.

---

*Lower Ca/S molar ratio (≈1.6) and higher combustion efficiency (≈96%) have been achieved in longer tests using Ohio #6 coal and Lowellville limestone. The objective of this test was not to optimize these variables.

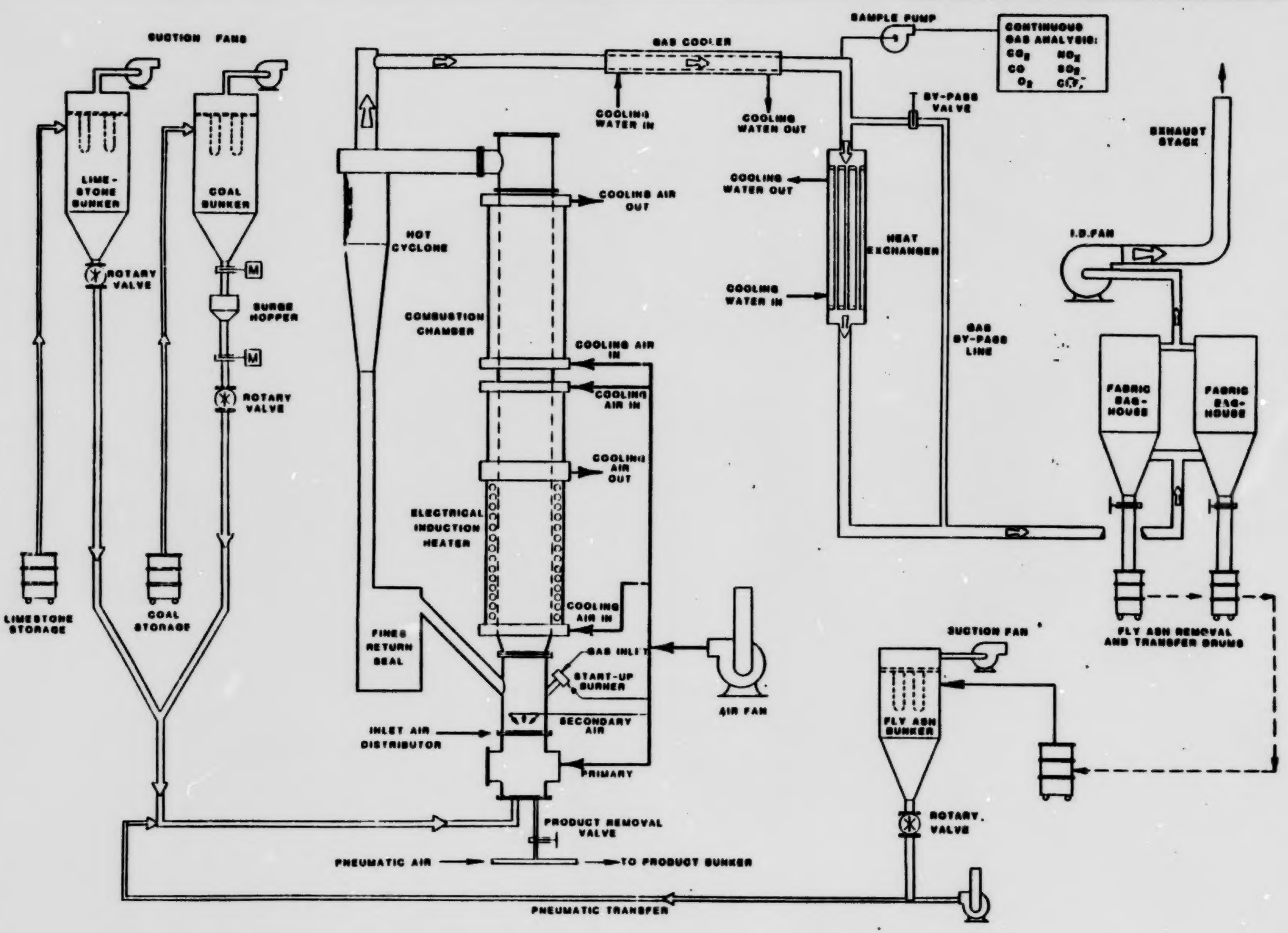

SUCTION FANS
LIME-STONE BUNKER
COAL BUNKER
ROTARY VALVE
M
SURGE HOPPER
M
ROTARY VALVE
LIMESTONE STORAGE
COAL STORAGE
HOT CYCLONE
COMBUSTION CHAMBER
ELECTRICAL INDUCTION HEATER
FINES RETURN SEAL
COOLING AIR OUT
COOLING AIR IN
COOLING AIR IN
COOLING AIR OUT
COOLING AIR IN
GAS INLET
START-UP BURNER
SECONDARY AIR
INLET AIR DISTRIBUTOR
PRIMARY
AIR FAN
PRODUCT REMOVAL VALVE
PNEUMATIC AIR
TO PRODUCT BUNKER
PNEUMATIC TRANSFER
GAS COOLER
COOLING WATER IN
COOLING WATER OUT
SAMPLE PUMP
CONTINUOUS GAS ANALYSIS:
CO_2
NO_x
CO
SO_2
O_2
C.T.
BY-PASS VALVE
COOLING WATER OUT
HEAT EXCHANGER
COOLING WATER IN
GAS BY-PASS LINE
EXHAUST STACK
I.D.FAN
FABRIC BAG-HOUSE
FABRIC BAG-HOUSE
FLY ASH REMOVAL AND TRANSFER DRUMS
SUCTION FAN
FLY ASH BUNKER
ROTARY VALVE

Figure B-1

16" CIRCULATING FLUID BED COMBUSTOR

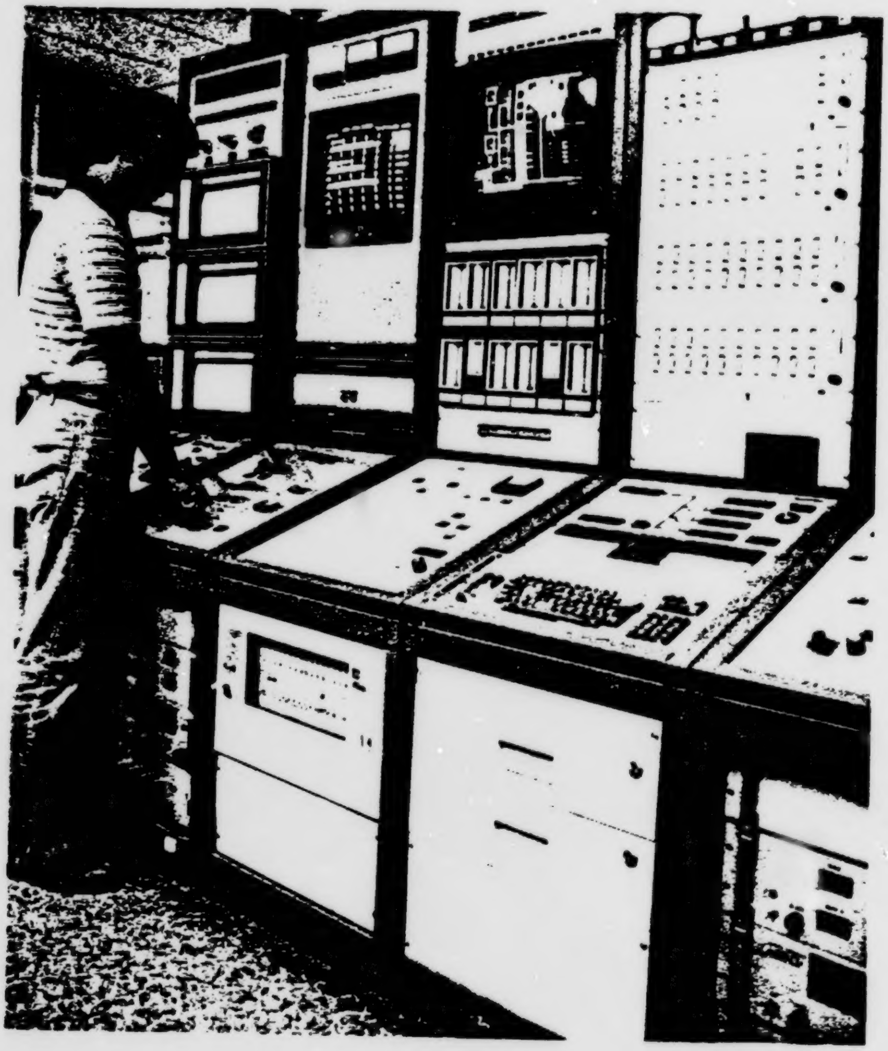


Figure B-2 Control Room For Pilot Plant Equipment

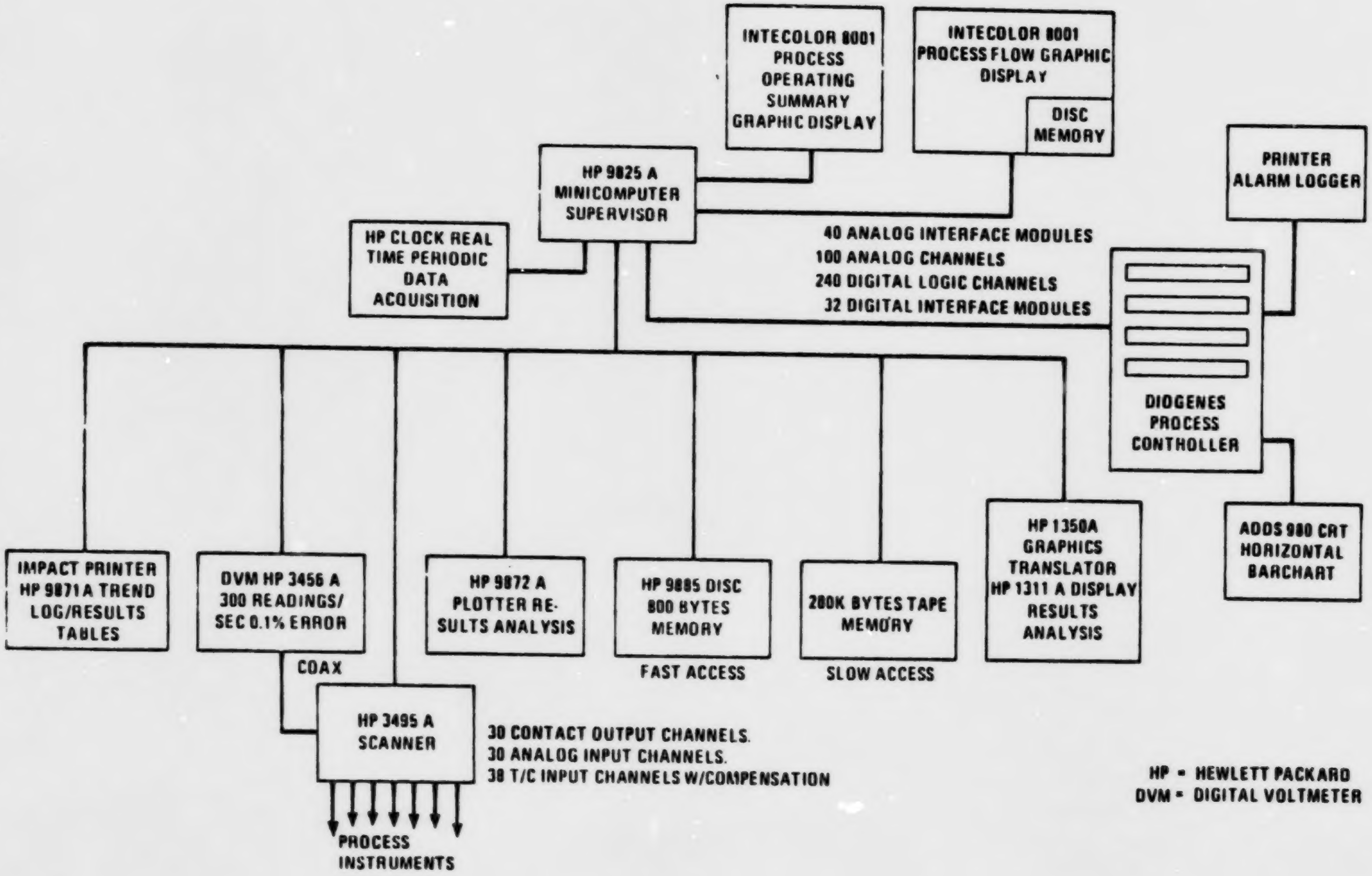

INTECOLOR 8001 PROCESS OPERATING SUMMARY GRAPHIC DISPLAY
INTECOLOR 8001 PROCESS FLOW GRAPHIC DISPLAY
DISC MEMORY
PRINTER ALARM LOGGER
HP 9825 A MINICOMPUTER SUPERVISOR
HP CLOCK REAL TIME PERIODIC DATA ACQUISITION
40 ANALOG INTERFACE MODULES
100 ANALOG CHANNELS
240 DIGITAL LOGIC CHANNELS
32 DIGITAL INTERFACE MODULES
DIOGENES PROCESS CONTROLLER
ADDS 980 CRT HORIZONTAL BARCHART
IMPACT PRINTER HP 9871 A TREND LOG/RESULTS TABLES
DVM HP 3456 A 300 READINGS/ SEC 0.1% ERROR
COAX
HP 9872 A PLOTTER RESULTS ANALYSIS
HP 9885 DISC 800 BYTES MEMORY
FAST ACCESS
280K BYTES TAPE MEMORY
SLOW ACCESS
HP 1350A GRAPHICS TRANSLATOR HP 1311 A DISPLAY RESULTS ANALYSIS
HP 3495 A SCANNER
30 CONTACT OUTPUT CHANNELS.
30 ANALOG INPUT CHANNELS.
38 T/C INPUT CHANNELS W/COMPENSATION
PROCESS INSTRUMENTS
HP - HEWLETT PACKARD
DVM = DIGITAL VOLTMETER

Figure B-3 Control center for the fluidized-bed combustors

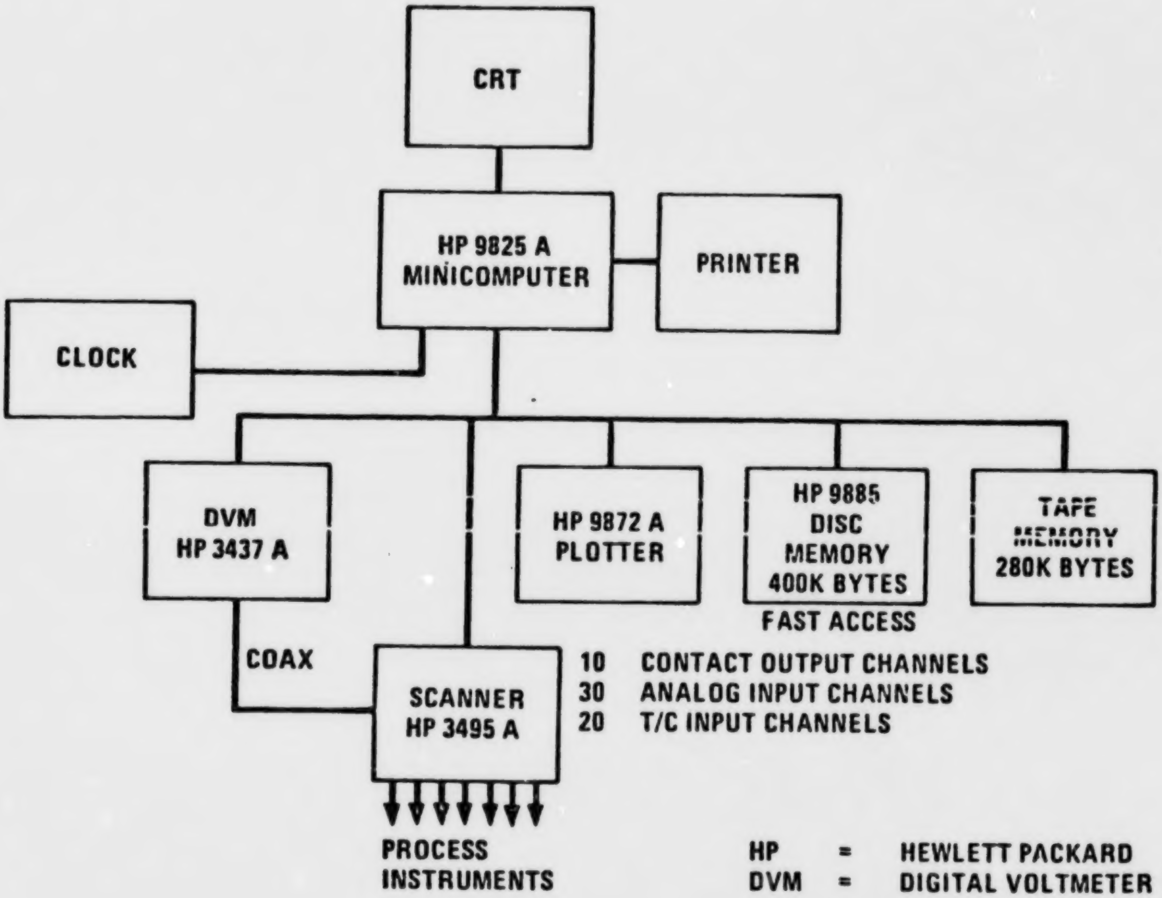

CRT
HP 9825 A MINICOMPUTER
PRINTER
CLOCK
DVM HP 3437 A
HP 9872 A PLOTTER
HP 9885 DISC MEMORY 400K BYTES FAST ACCESS
TAPE MEMORY 280K BYTES
COAX
SCANNER HP 3495 A
10 CONTACT OUTPUT CHANNELS
30 ANALOG INPUT CHANNELS
20 T/C INPUT CHANNELS
PROCESS INSTRUMENTS
HP = HEWLETT PACKARD
DVM = DIGITAL VOLTMETER

Figure B-4 Results/Program development center for 16 - in. fluidized-bed combustor

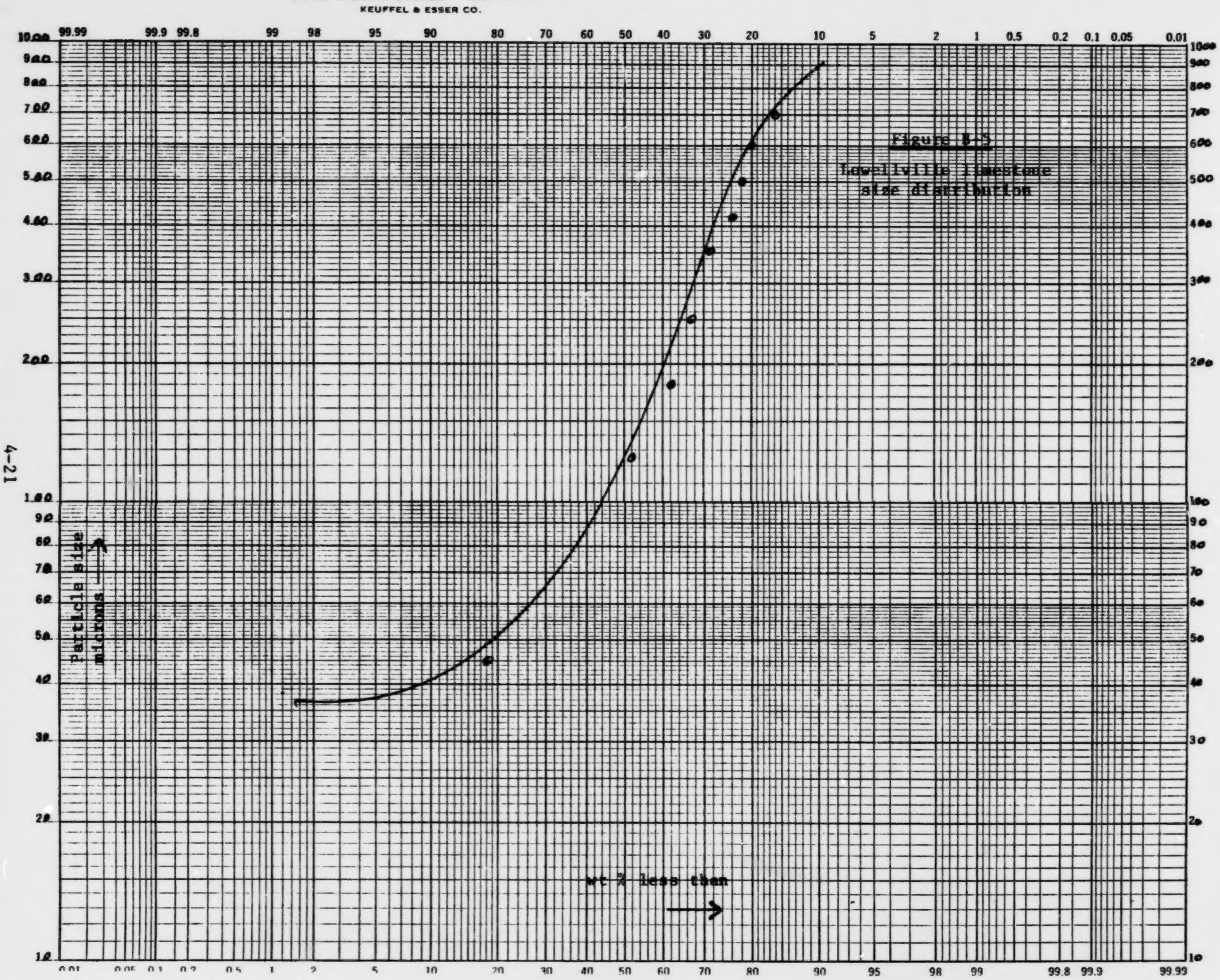


Figure B-5

Lowellville limestone size distribution

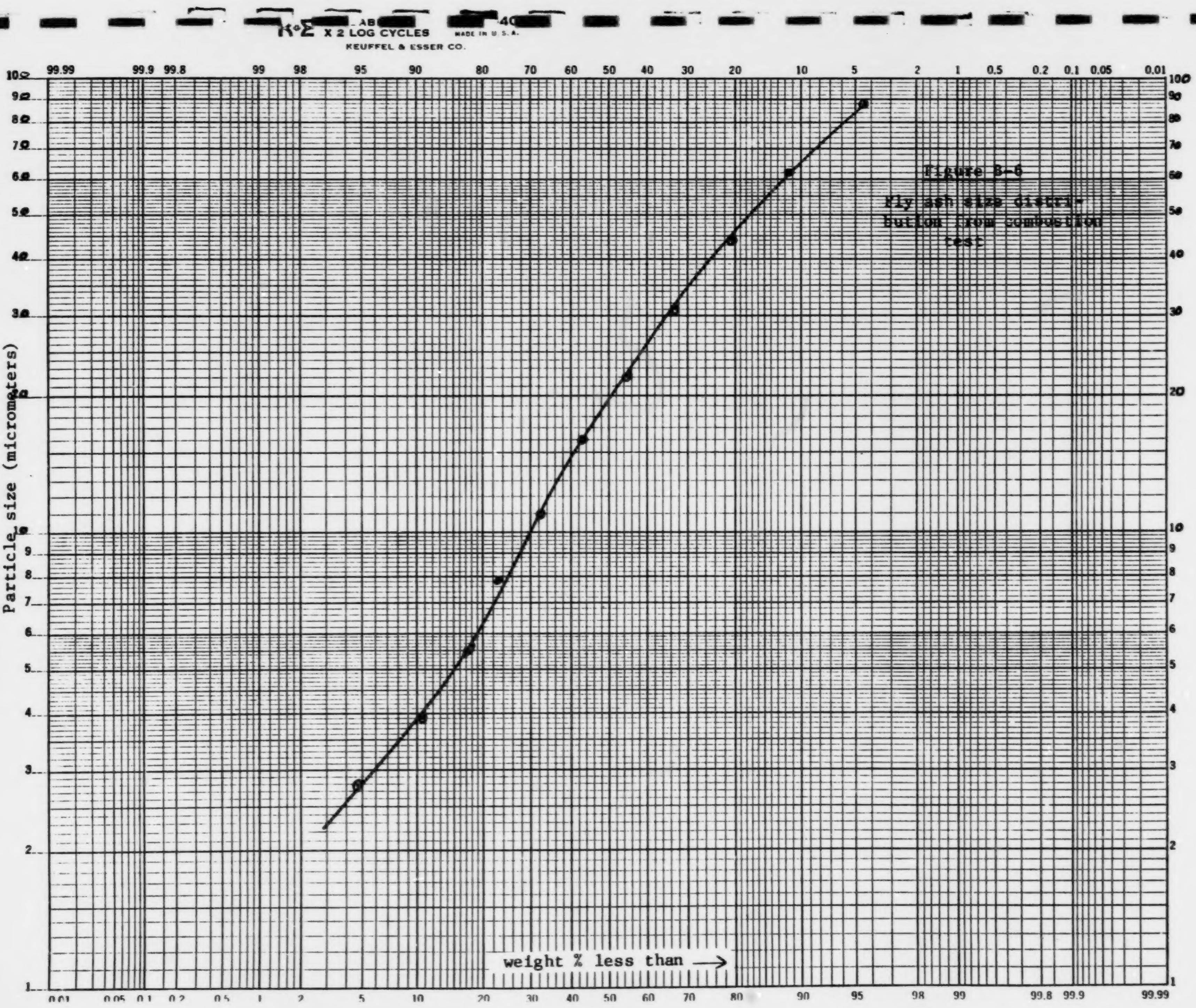
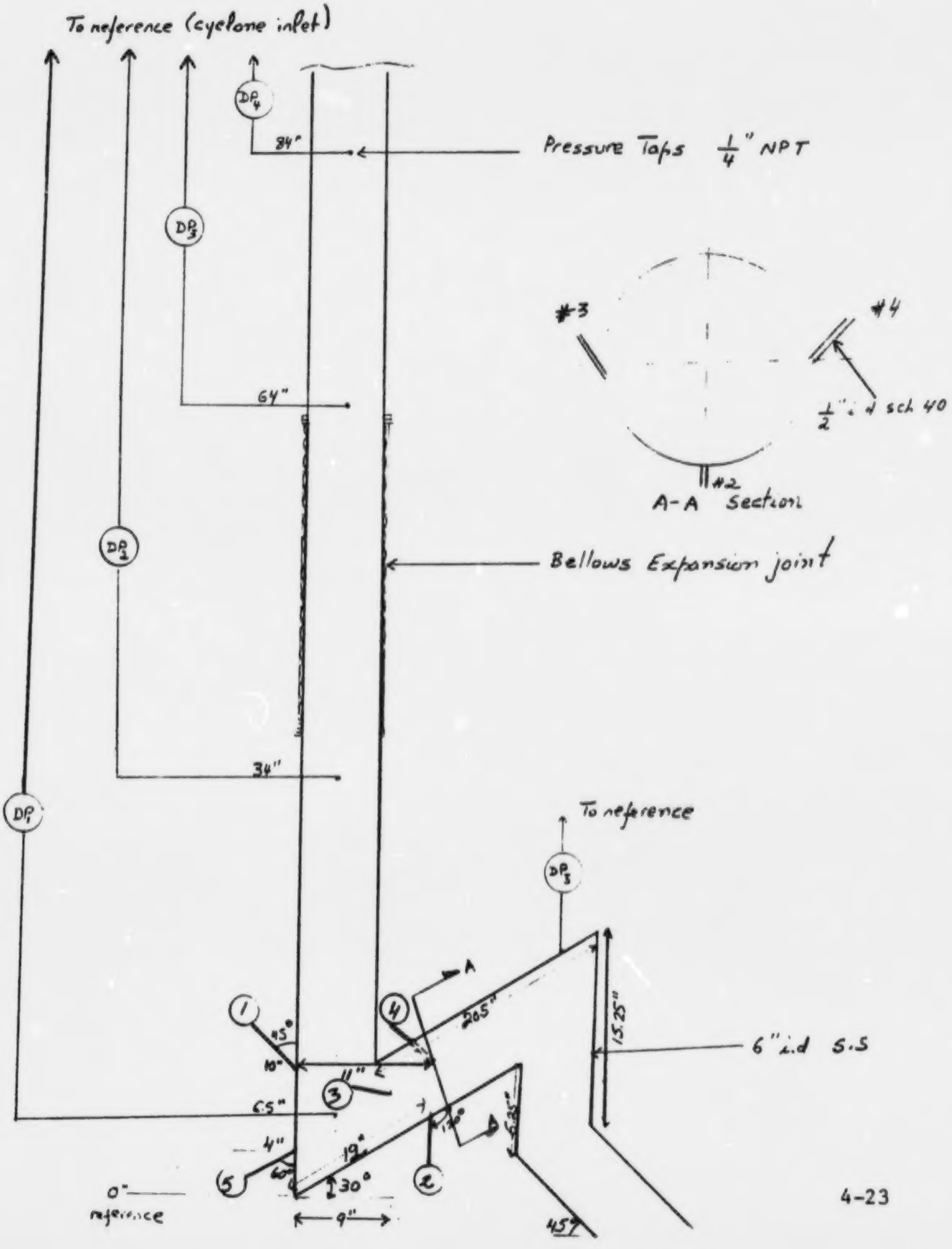


Figure B-6

Fly ash size distribution from combustion test

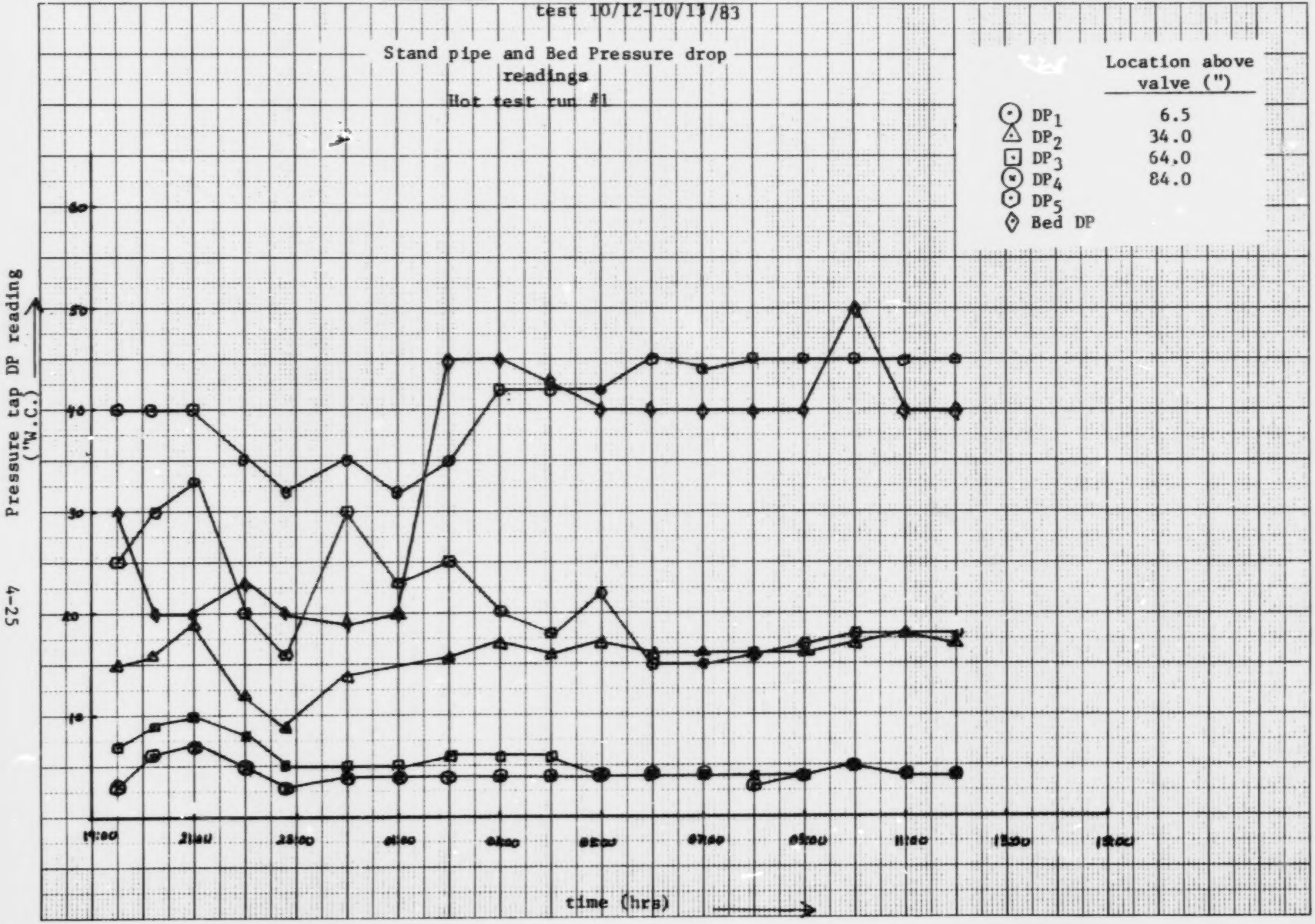
FIGURE B-7

CONFIGURATION OF INCLINED L-VALVE TESTED IN HOT COMBUSTION MODE


To reference (cyclone inlet)
DP_4
84"
Pressure Taps $\frac{1}{4}$" NPT
DP_3
#3
#4
$\frac{1}{2}$" i.d sch 40
64"
#2
A-A Section
DP_2
Bellows Expansion joint
34"
DP_1
To reference
DP_5
A
1
45°
4
20.5"
15.25"
10"
11"
6" i.d S.S
3
6.5"
120°
6.25"
4"
19°
60°
5
30°
2
0"
reference
9"
45°

K+E KEUFFEL & ESSER CO. MADE IN U.S.A. 461510

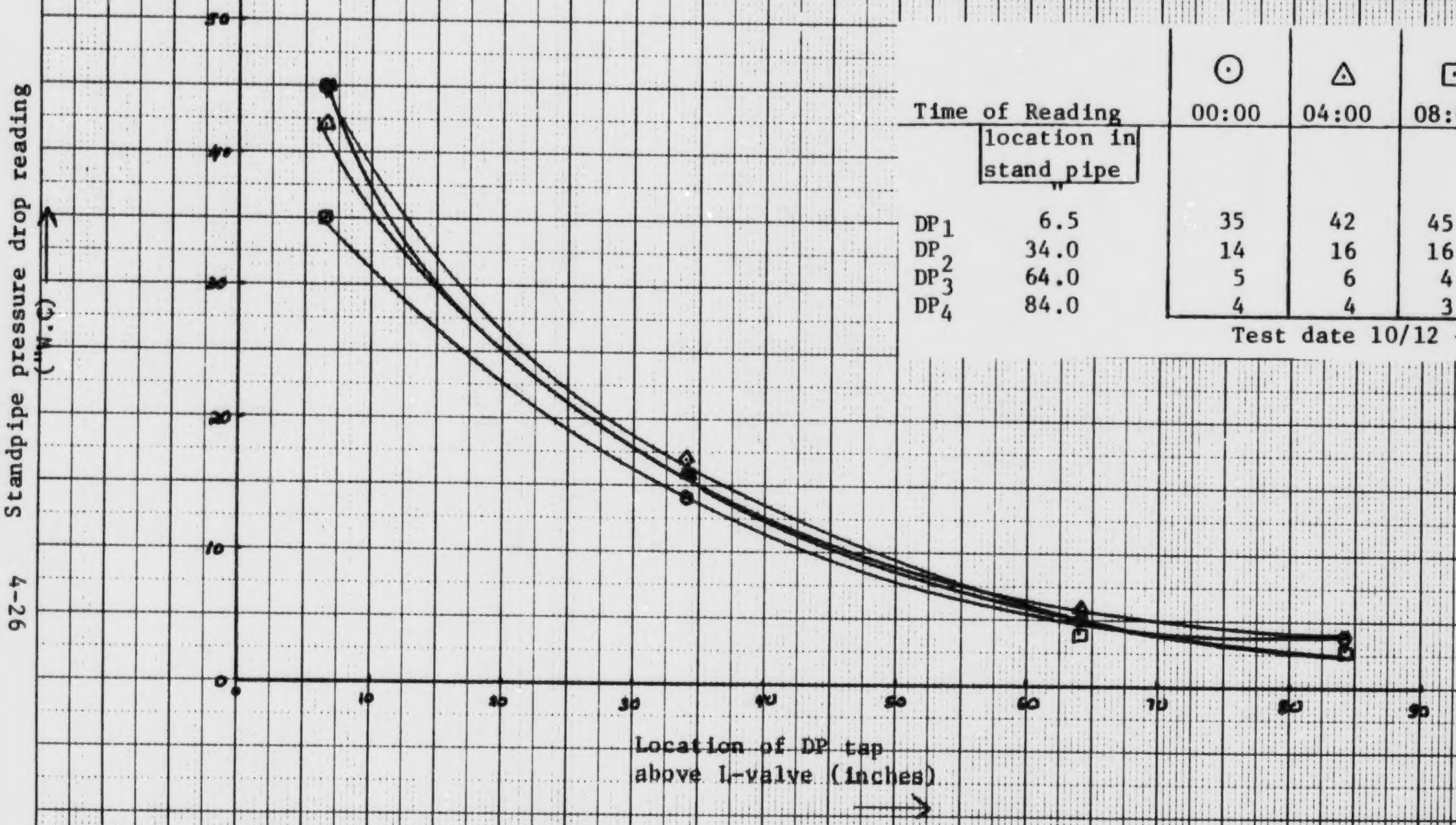
Figure B-8 Hot combustion test 10/12-10/13/83



K&E KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure B-9

Hot Test
Stand pipe height
vs
Pressure drop reading
Hot test run #1

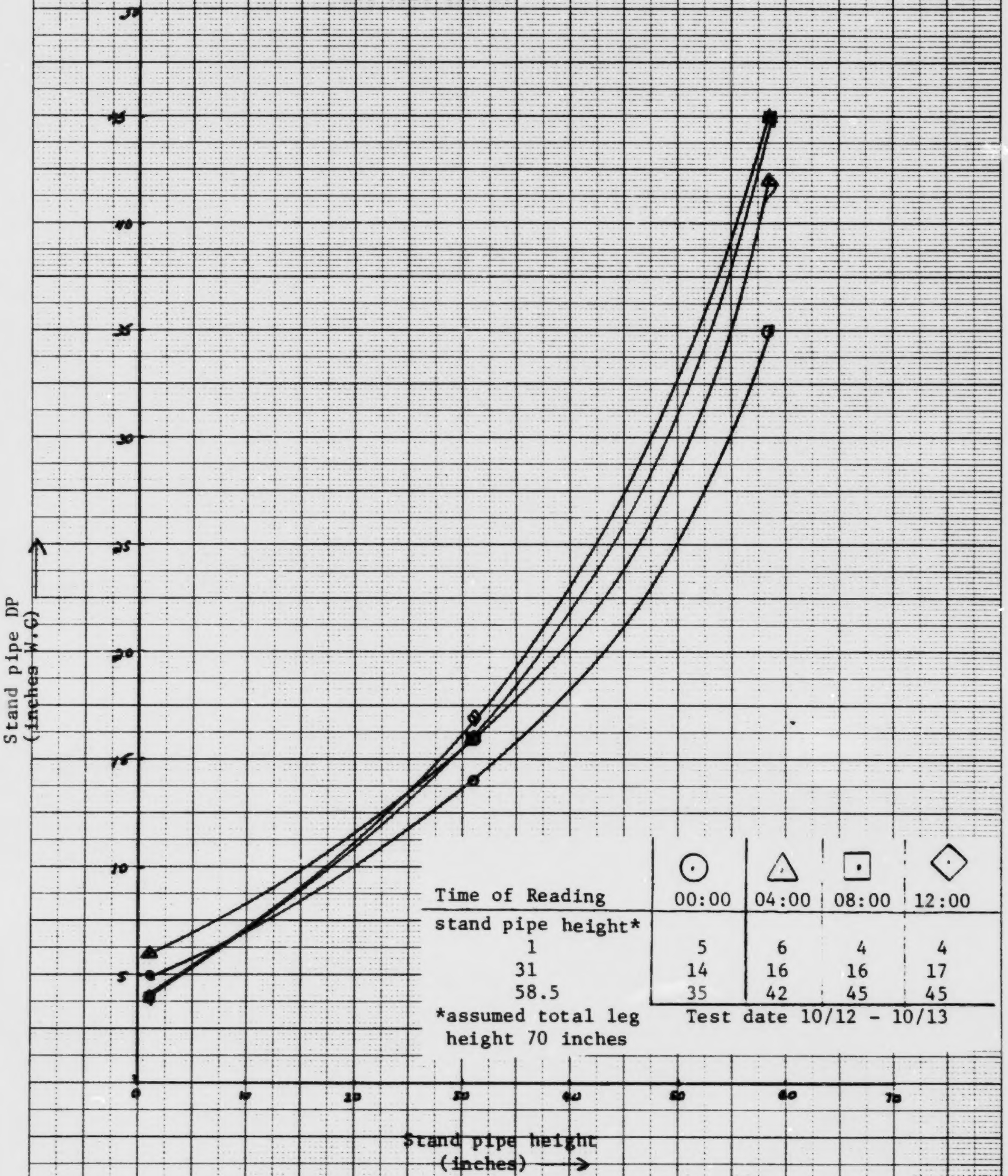


Time of Reading	location in stand pipe "	⊙ 00:00	△ 04:00	⊡ 08:00	◇ 12:00
DP_1	6.5	35	42	45	45
DP_2	34.0	14	16	16	17
DP_3	64.0	5	6	4	4
DP_4	84.0	4	4	3	3

Test date 10/12 - 10/13

Figure B-10

Stand pipe height
vs
Stand pipe DP
Hot test run #1



Time of Reading	⊙ 00:00	△ 04:00	⊡ 08:00	◇ 12:00
stand pipe height*				
1	5	6	4	4
31	14	16	16	17
58.5	35	42	45	45

*assumed total leg height 70 inches

Test date 10/12 - 10/13

KEUFFEL & ESSER CO. MADE IN U.S.A.

K+E KEUFFEL & ESSER CO MADE IN U.S.A

Figure B-11 Hot combustion test 10/28/83

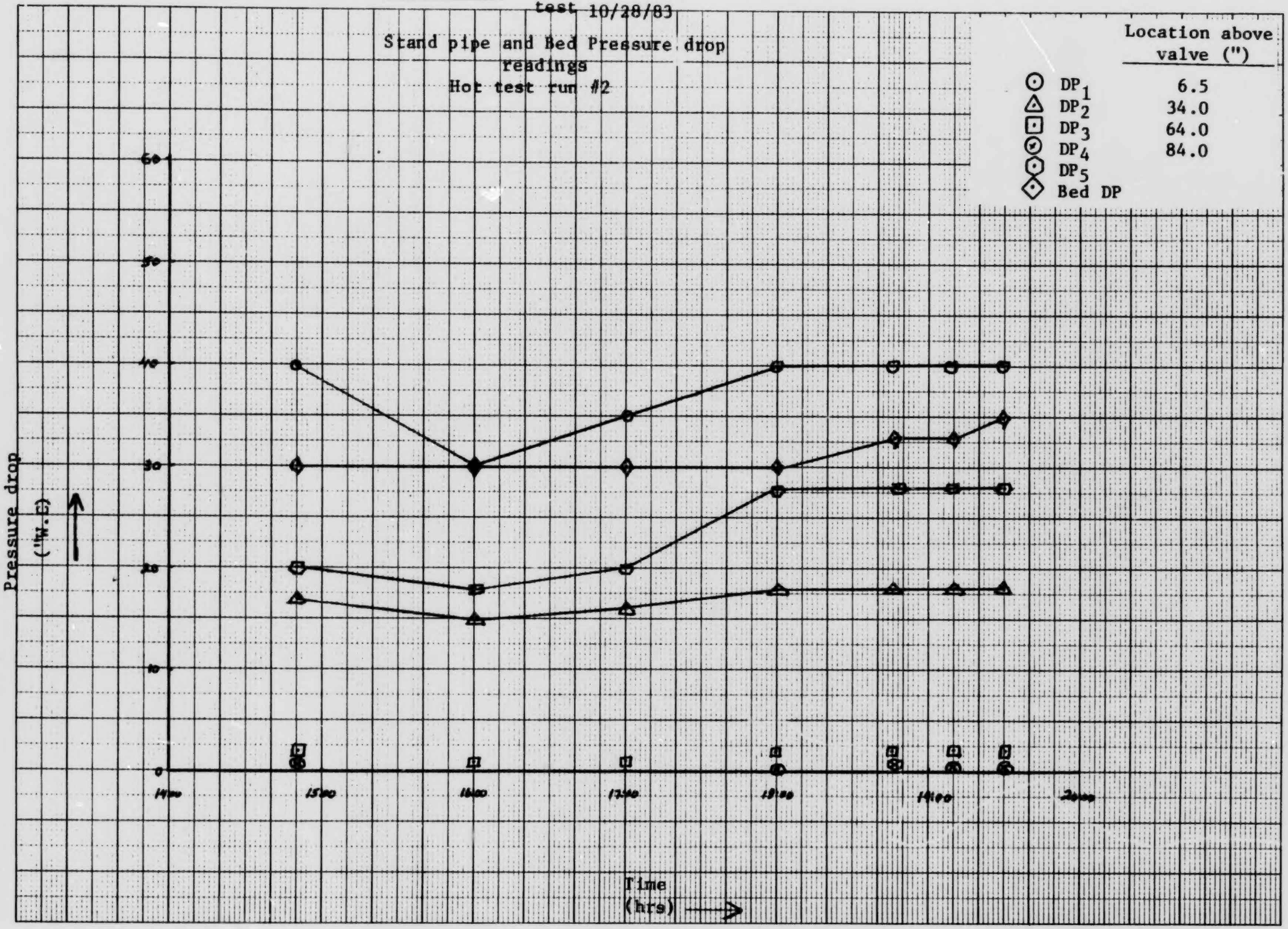
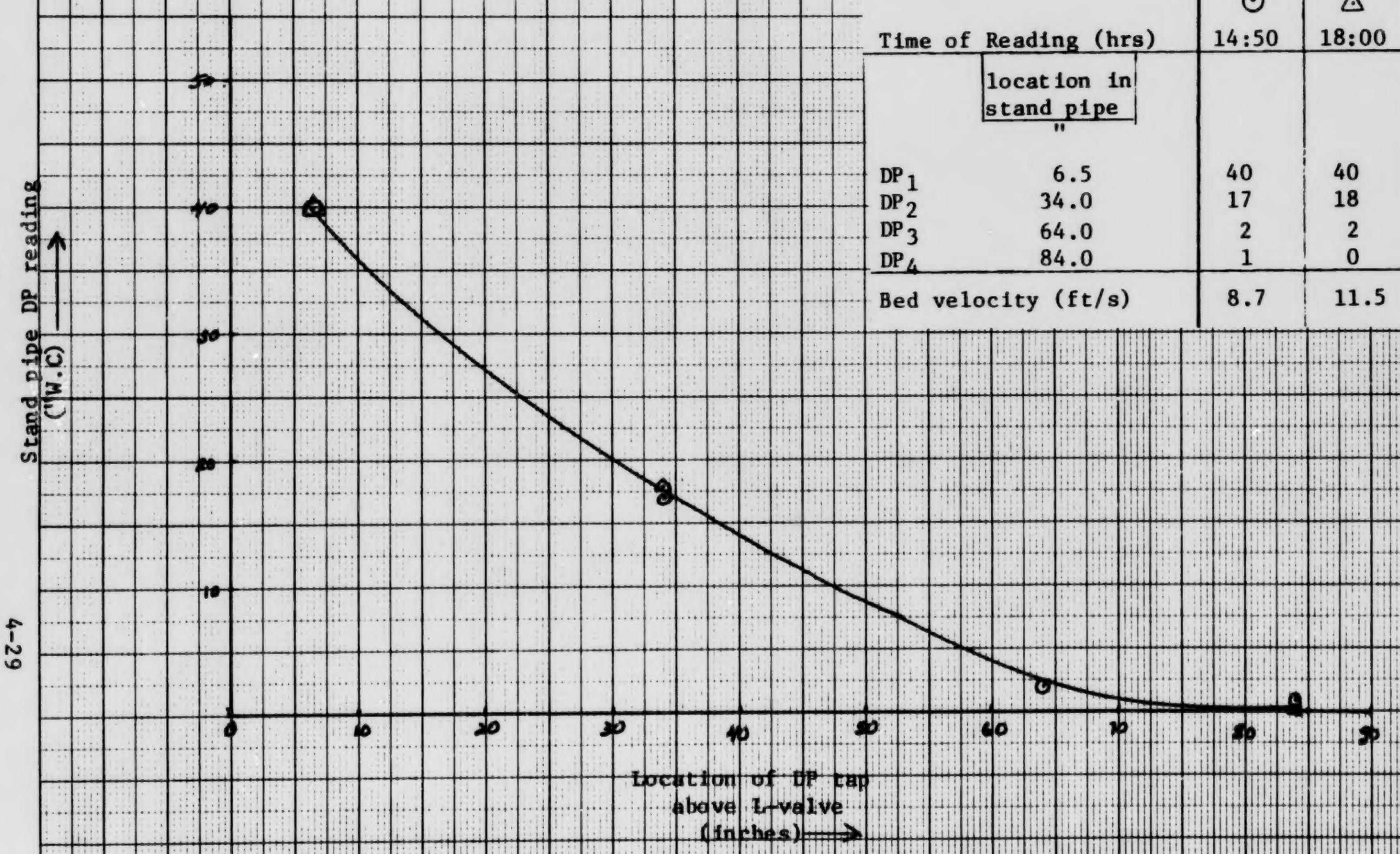


Figure B-12 Hot combustion test 10/28/83

Stand pipe height
vs
Stand pipe DP
Hot test run #2

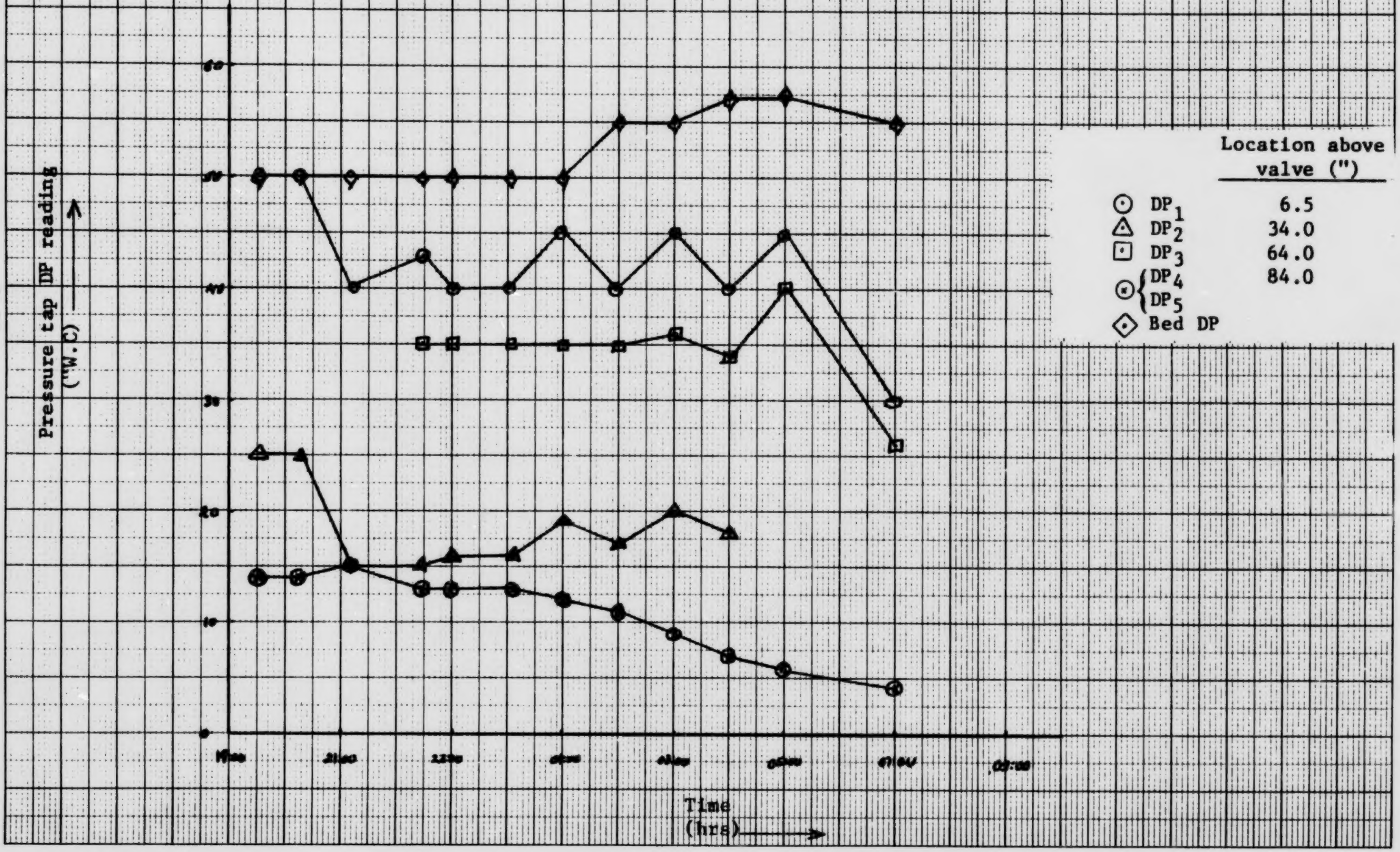


	location in stand pipe "	⊙ 14:50	△ 18:00	⊡ 18:45	◇ 19:25
DP_1	6.5	40	40	40	40
DP_2	34.0	17	18	18	18
DP_3	64.0	2	2	2	2
DP_4	84.0	1	0	1	1
Bed velocity (ft/s)		8.7	11.5	12.0	16.0

K•E KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure B-13 Hot combustion test 12/14-12/15/83 Test run #3

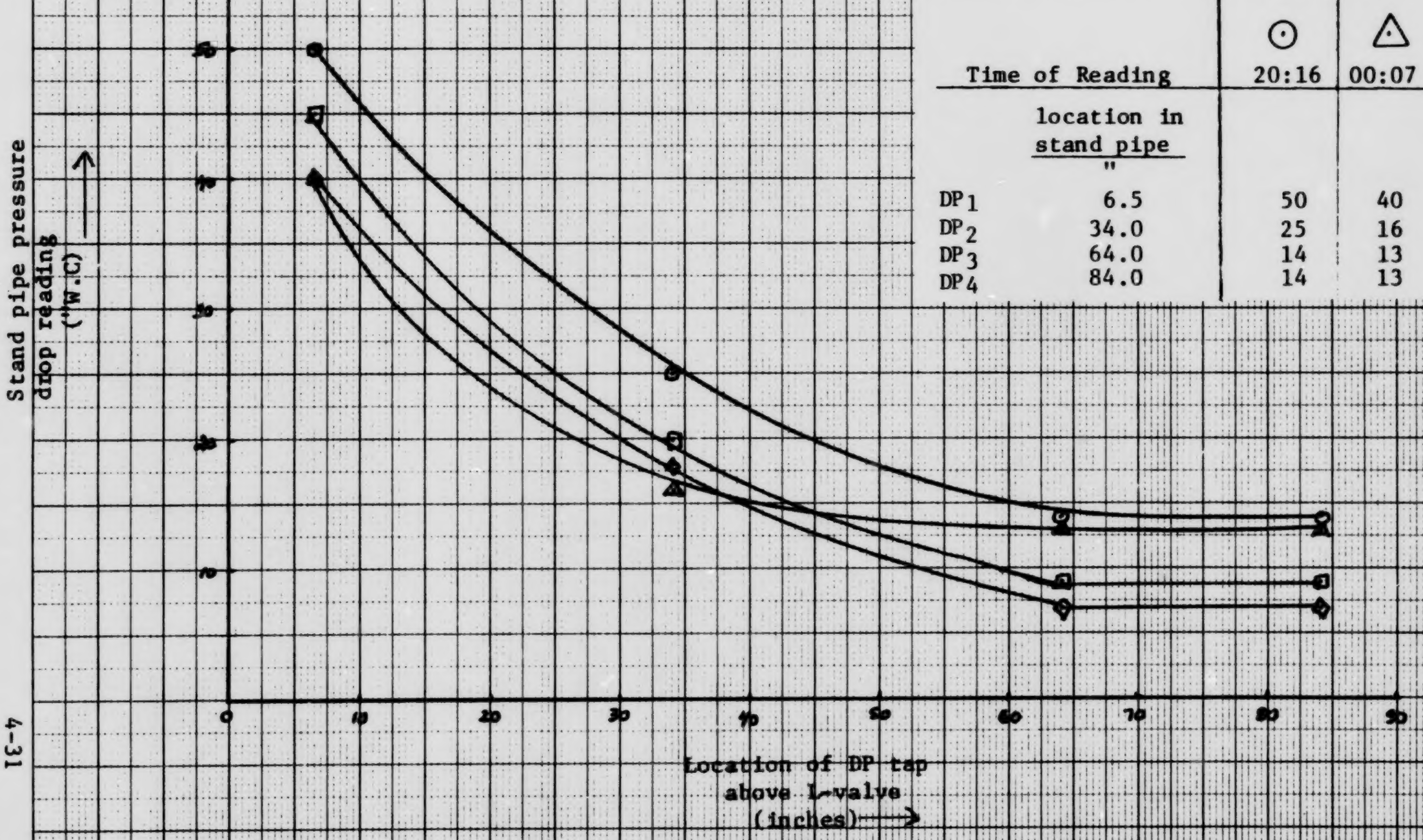
Stand pipe and Bed Pressure drop readings



K+E KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure B-14 Hot combustion test Test run #3
12/14 - 12/15, 1983

Stand pipe height
vs
Pressure drop reading



Time of Reading	location in stand pipe "	⊙ 20:16	△ 00:07	⊡ 03:00	◇ 04:00
DP_1	6.5	50	40	45	40
DP_2	34.0	25	16	20	18
DP_3	64.0	14	13	9	7
DP_4	84.0	14	13	9	7

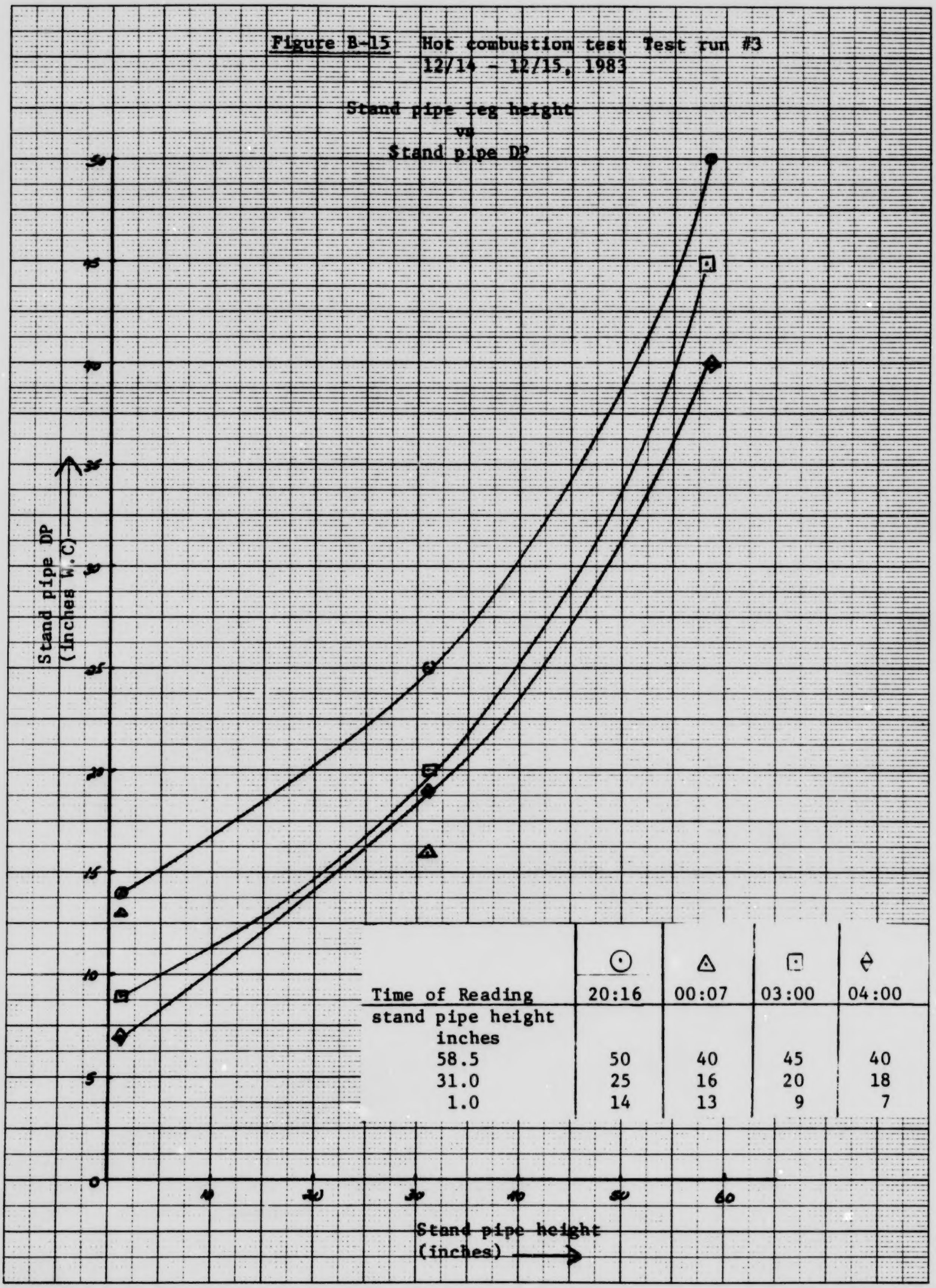


Figure B-15 Hot combustion test Test run #3
12/14 - 12/15, 1983

Stand pipe leg height
vs
Stand pipe DP

	⊙	△	⊡	◇
Time of Reading	20:16	00:07	03:00	04:00
stand pipe height inches				
58.5	50	40	45	40
31.0	25	16	20	18
1.0	14	13	9	7

KEUFFEL & ESSER CO. MADE IN U.S.A.

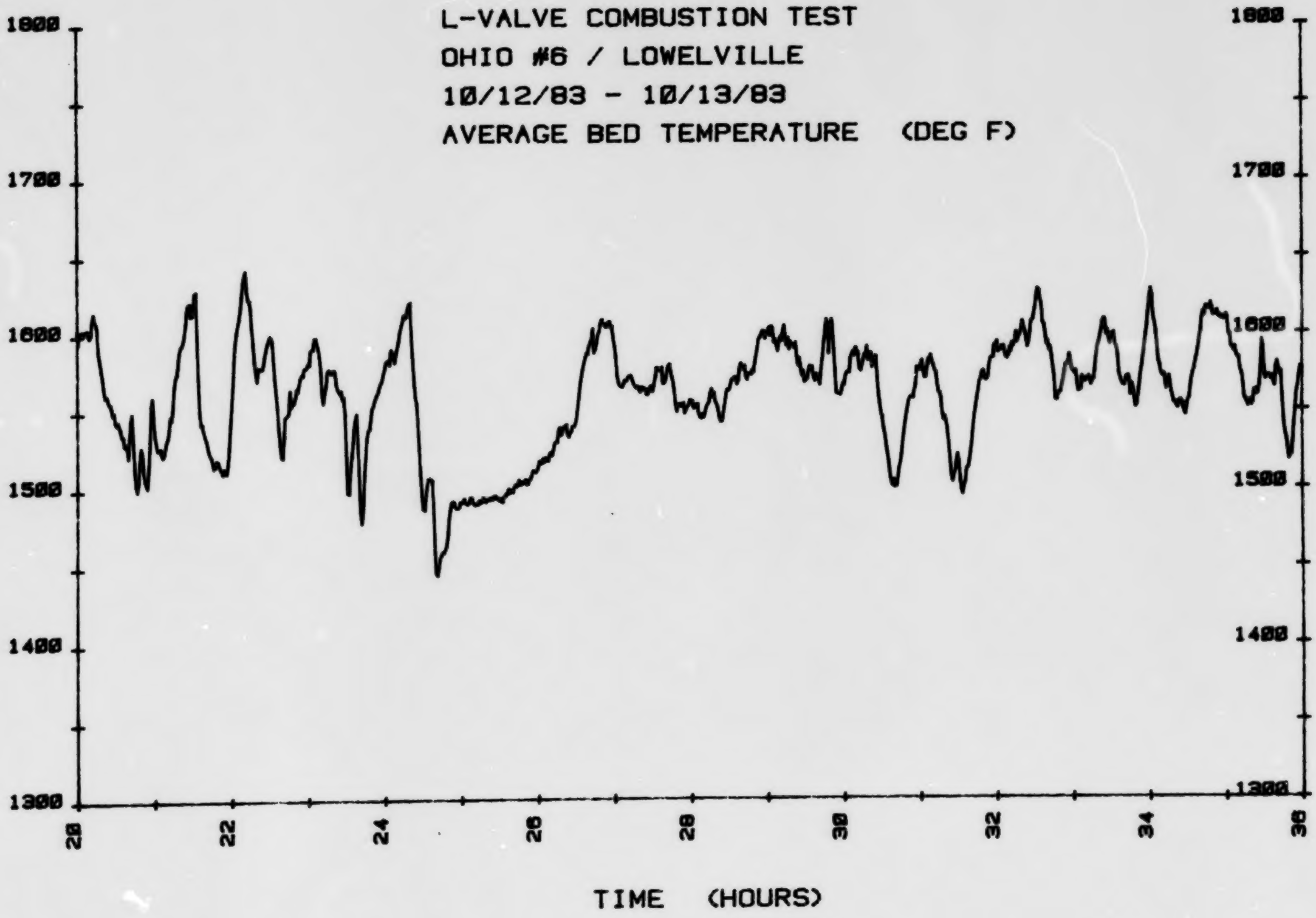


FIGURE B-16 Hot Test Run #1

FIGURE B-17 Hot Test Run #1

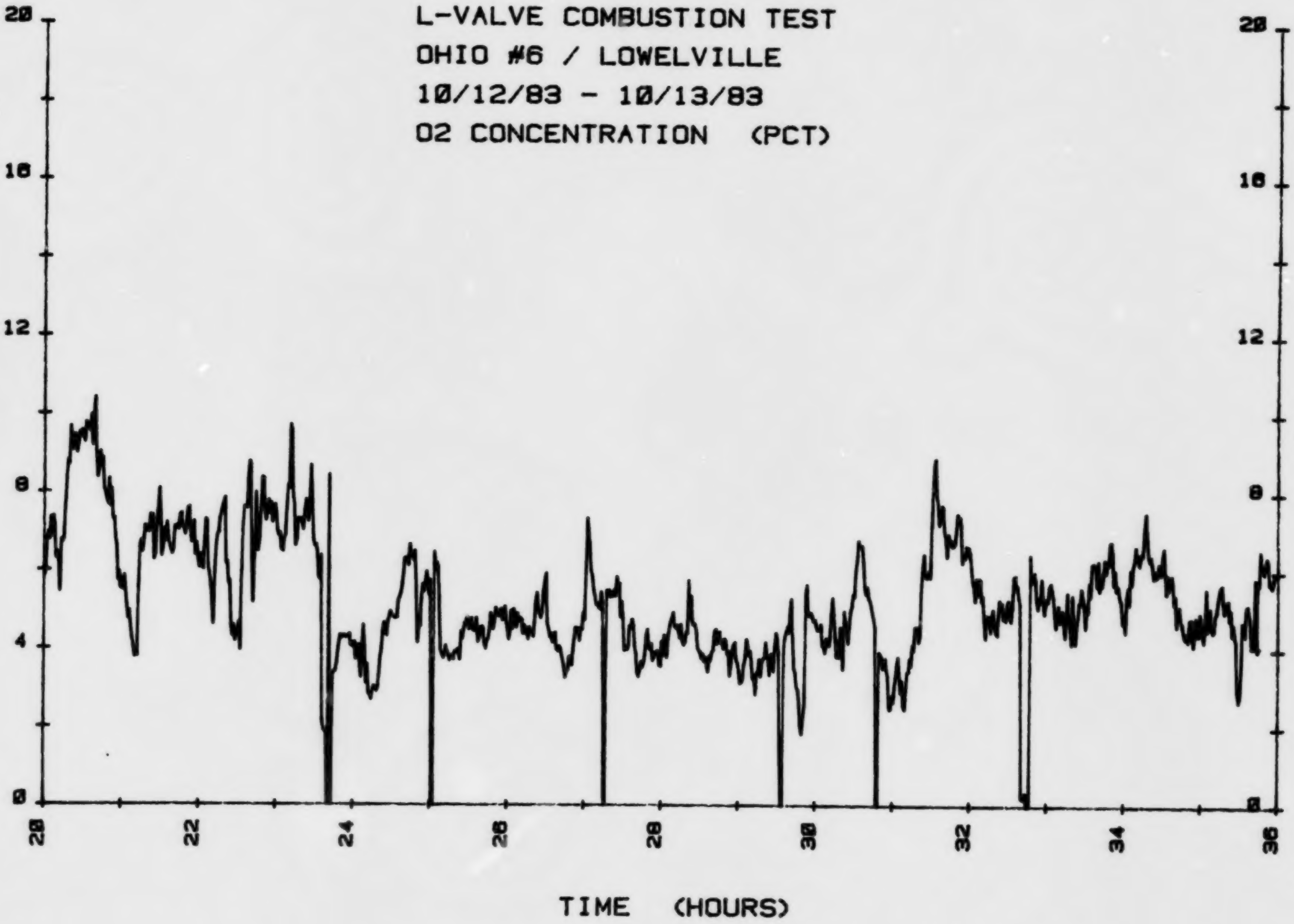


FIGURE B-18 Hot Test Run #1

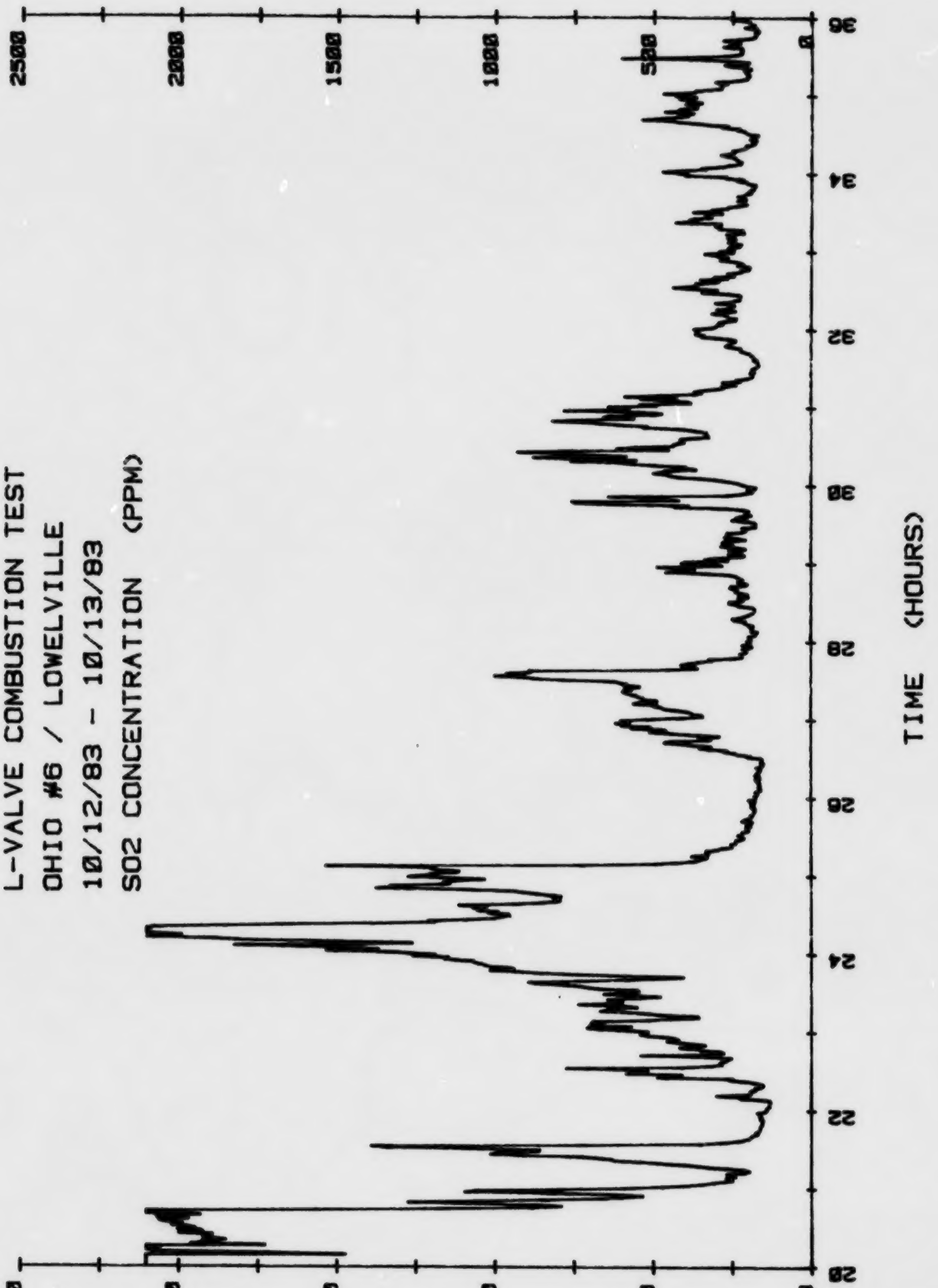


FIGURE B-19 Hot Test Run #1

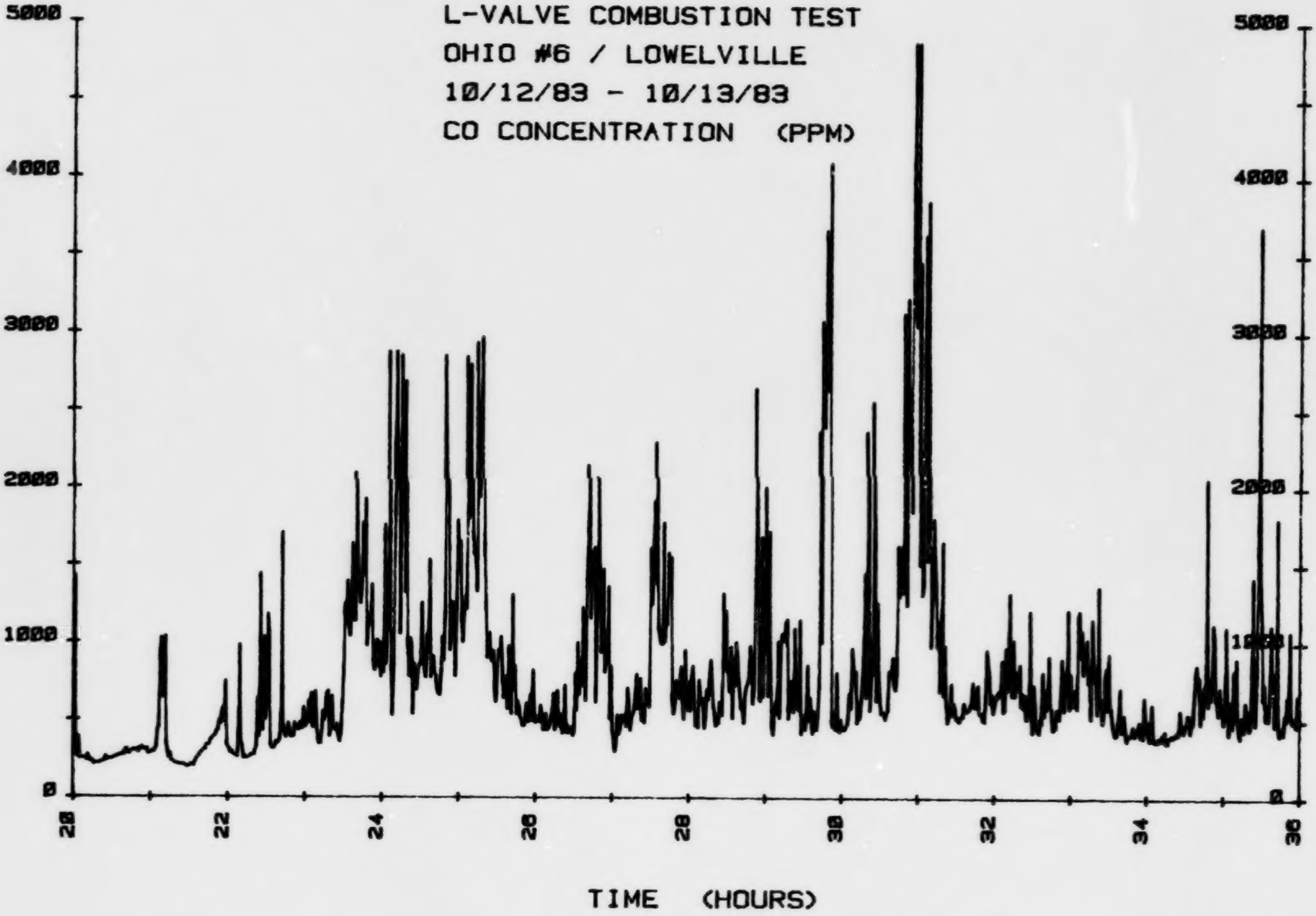


FIGURE B-20 Hot Test Run #1

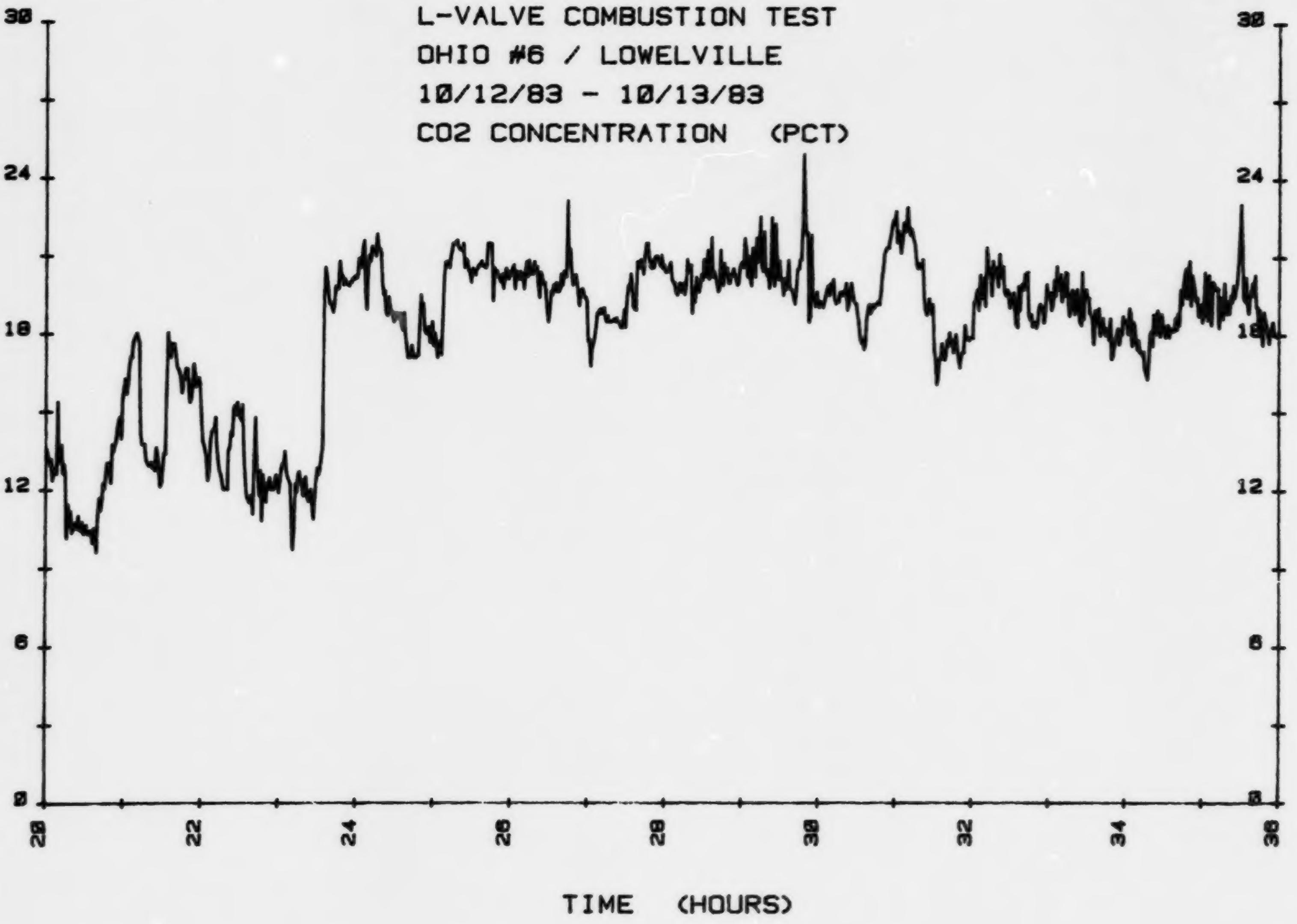


FIGURE B-21 Hot Test Run #1

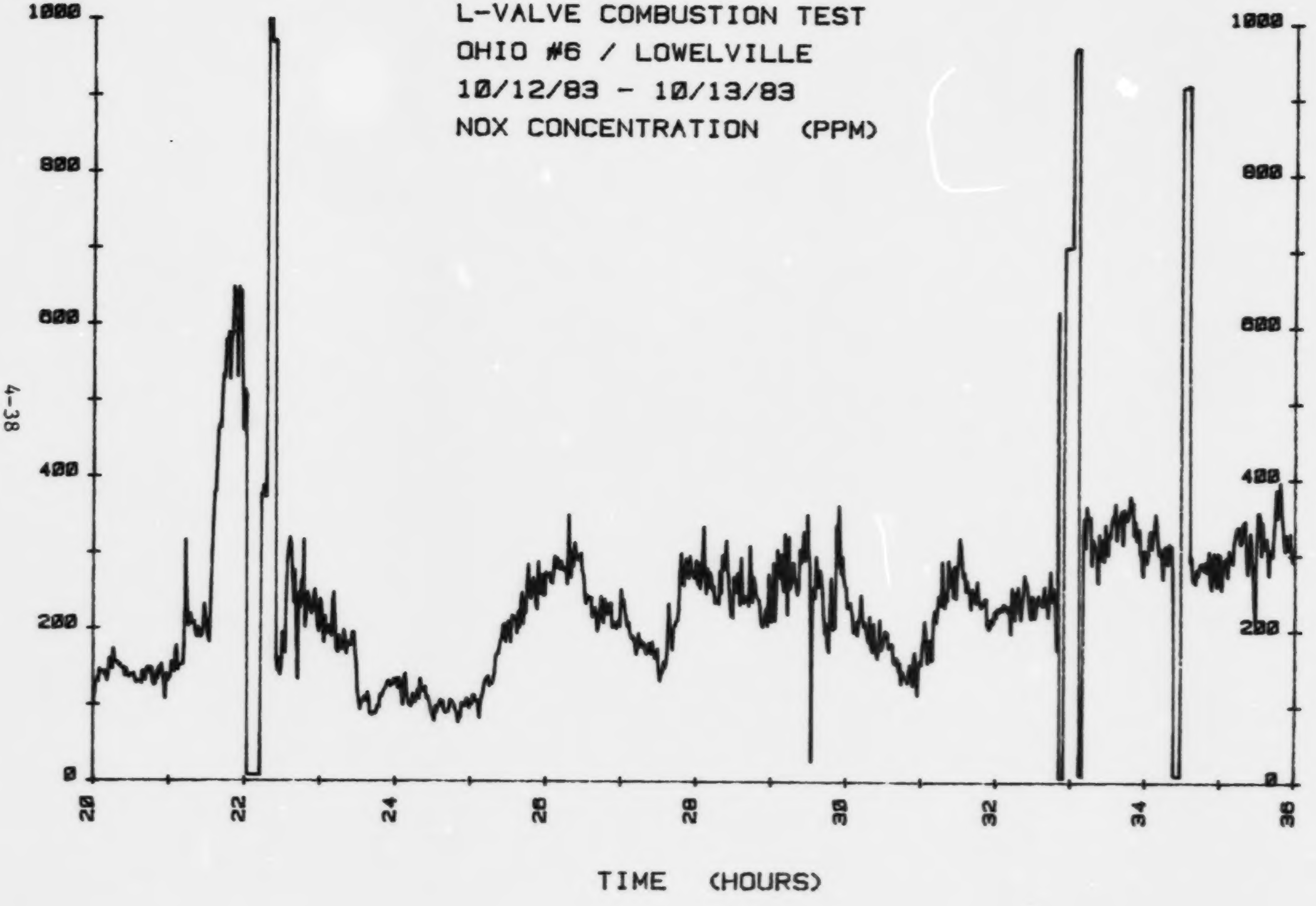


FIGURE B-22 Hot Test Run #1

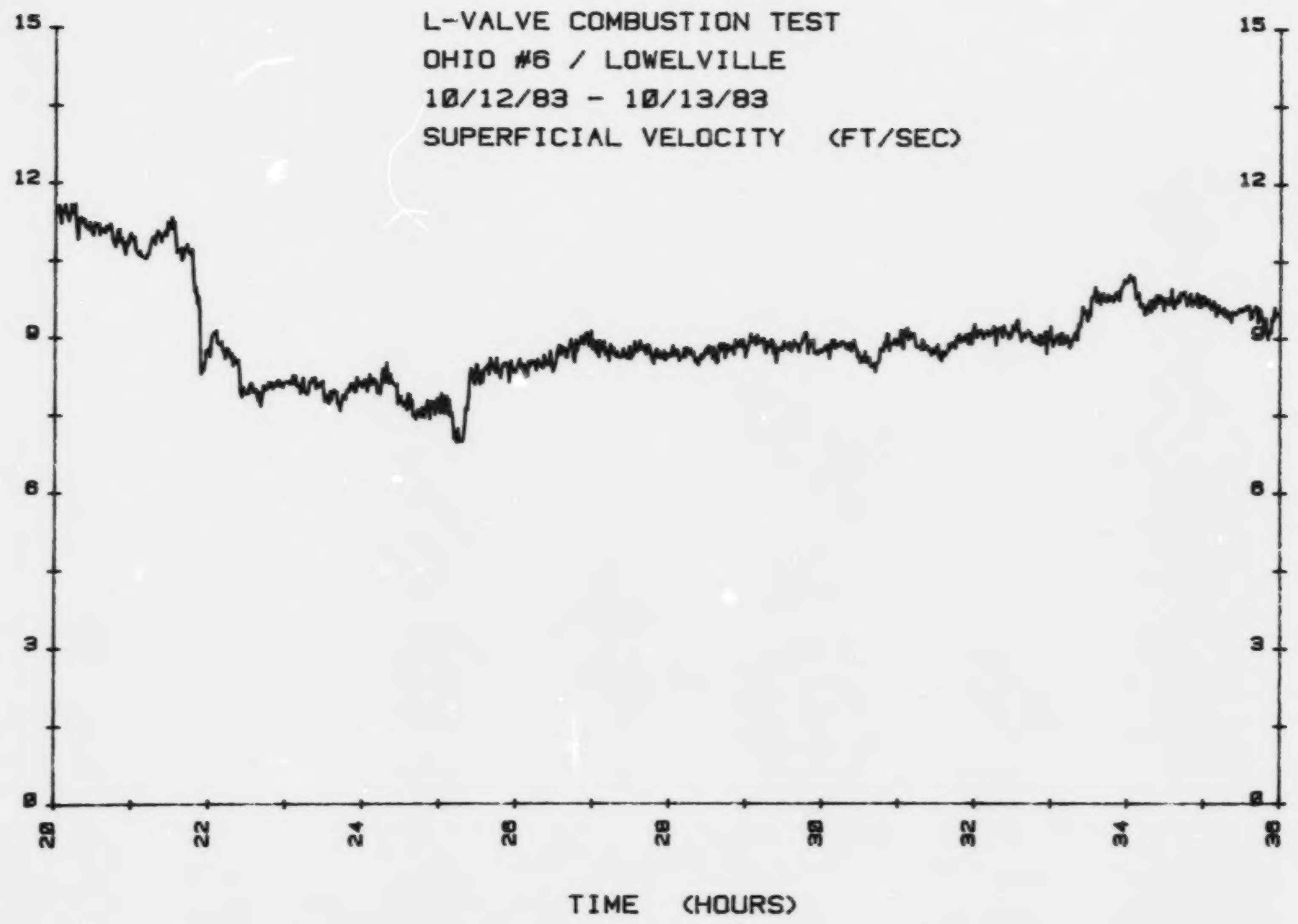


FIGURE B-23 Hot Test Run #1

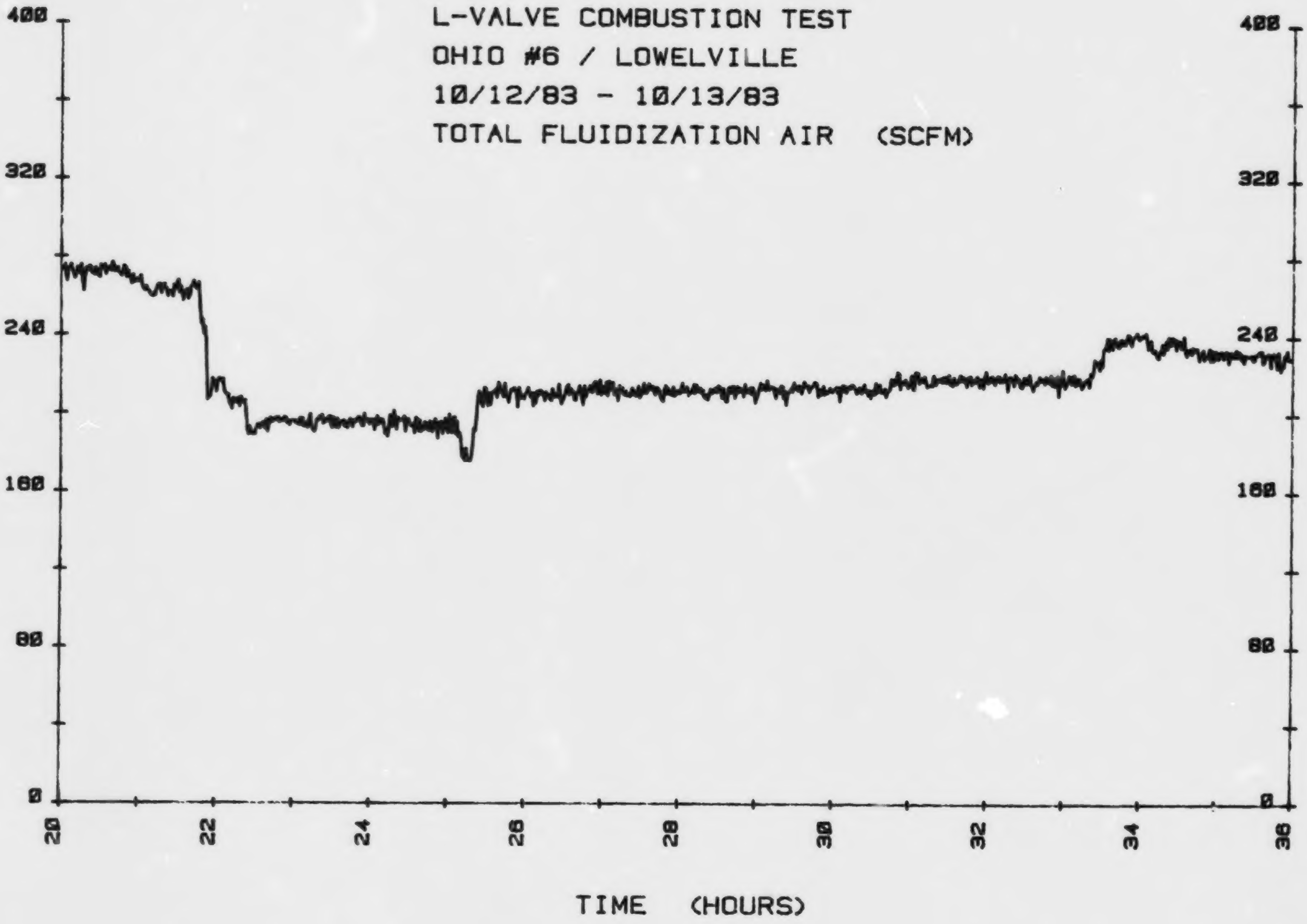


FIGURE B-24 Hot Test Run #1

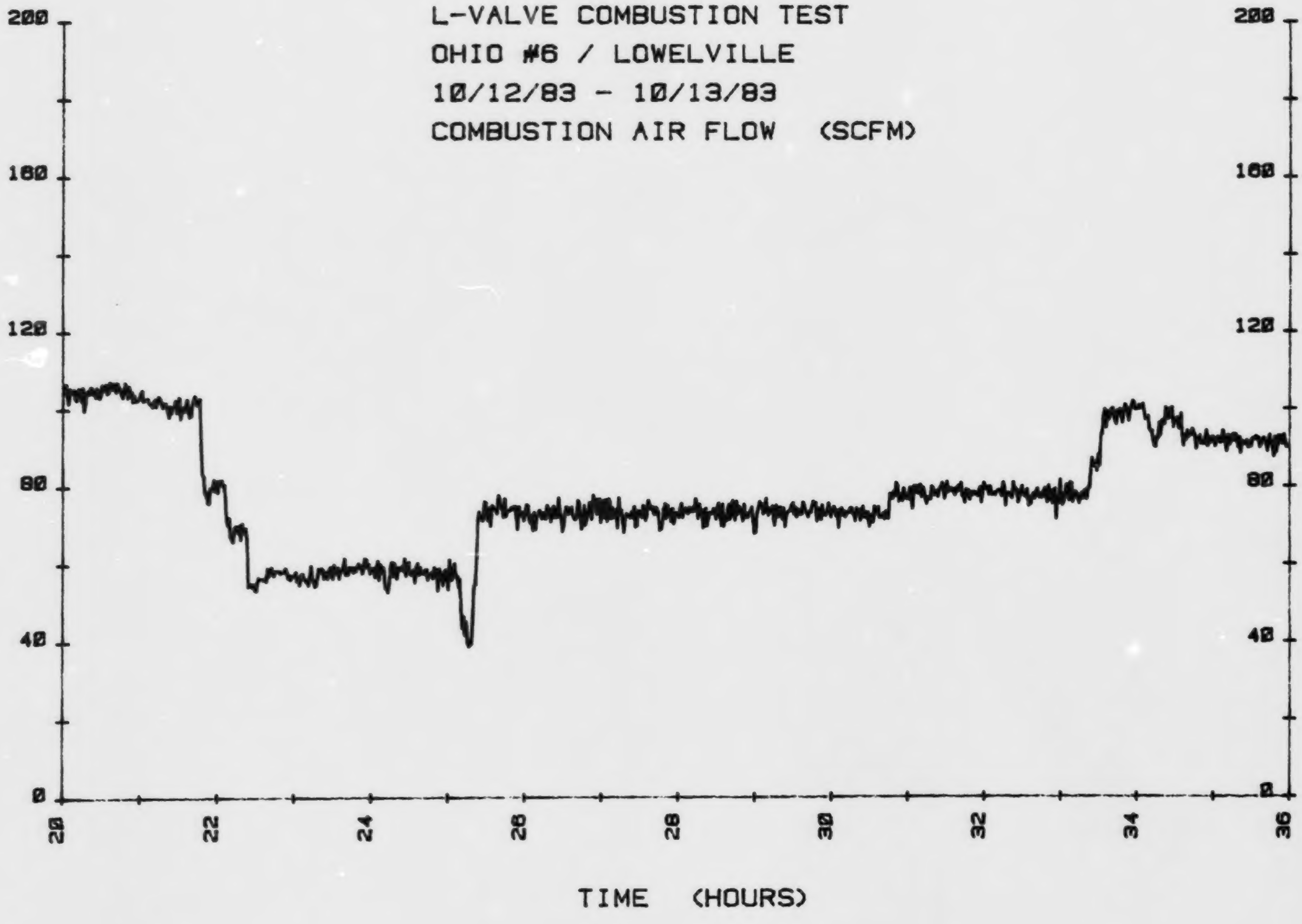


FIGURE B-25 Hot Test Run #1

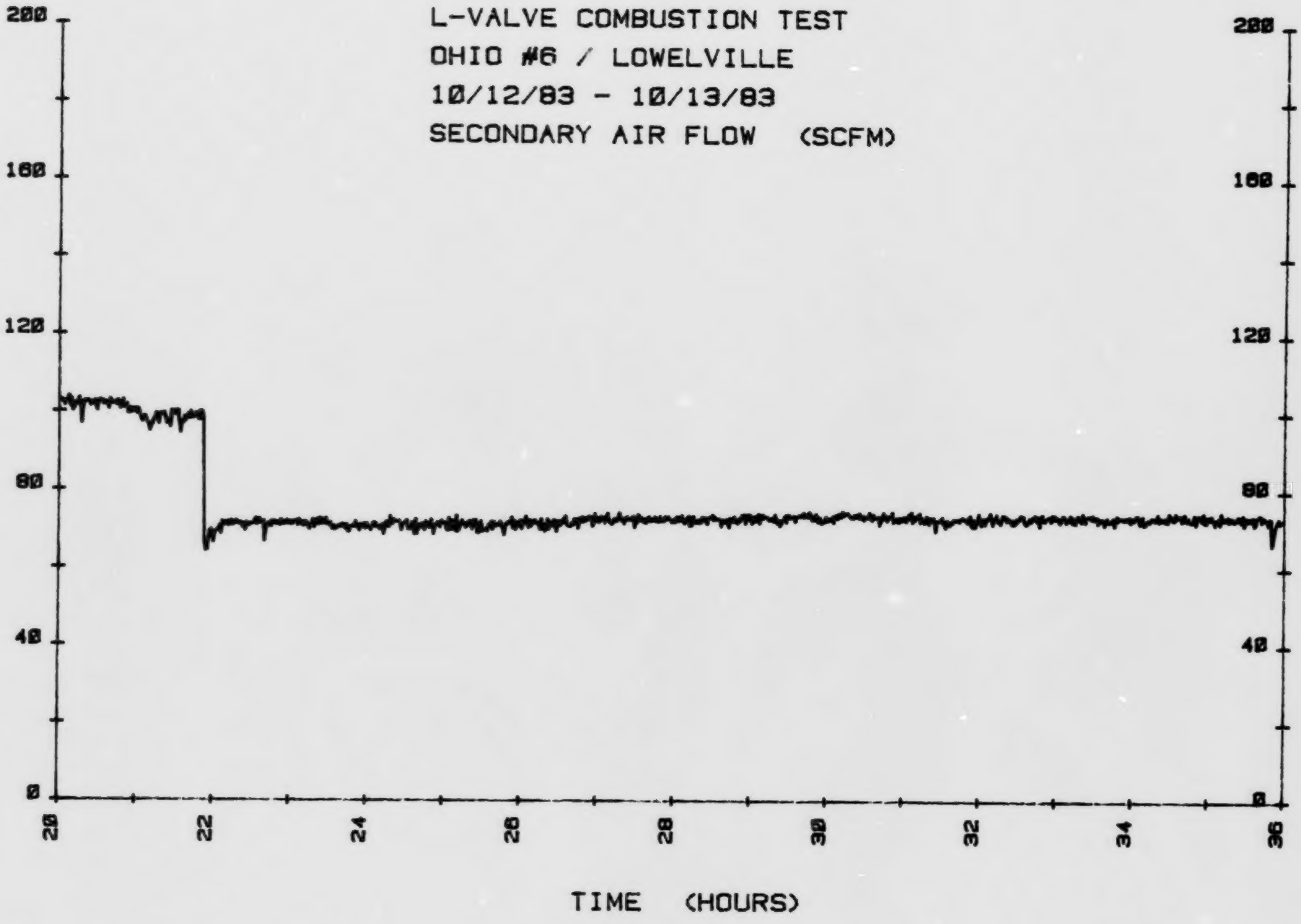


FIGURE B-26 Hot Test Run #1

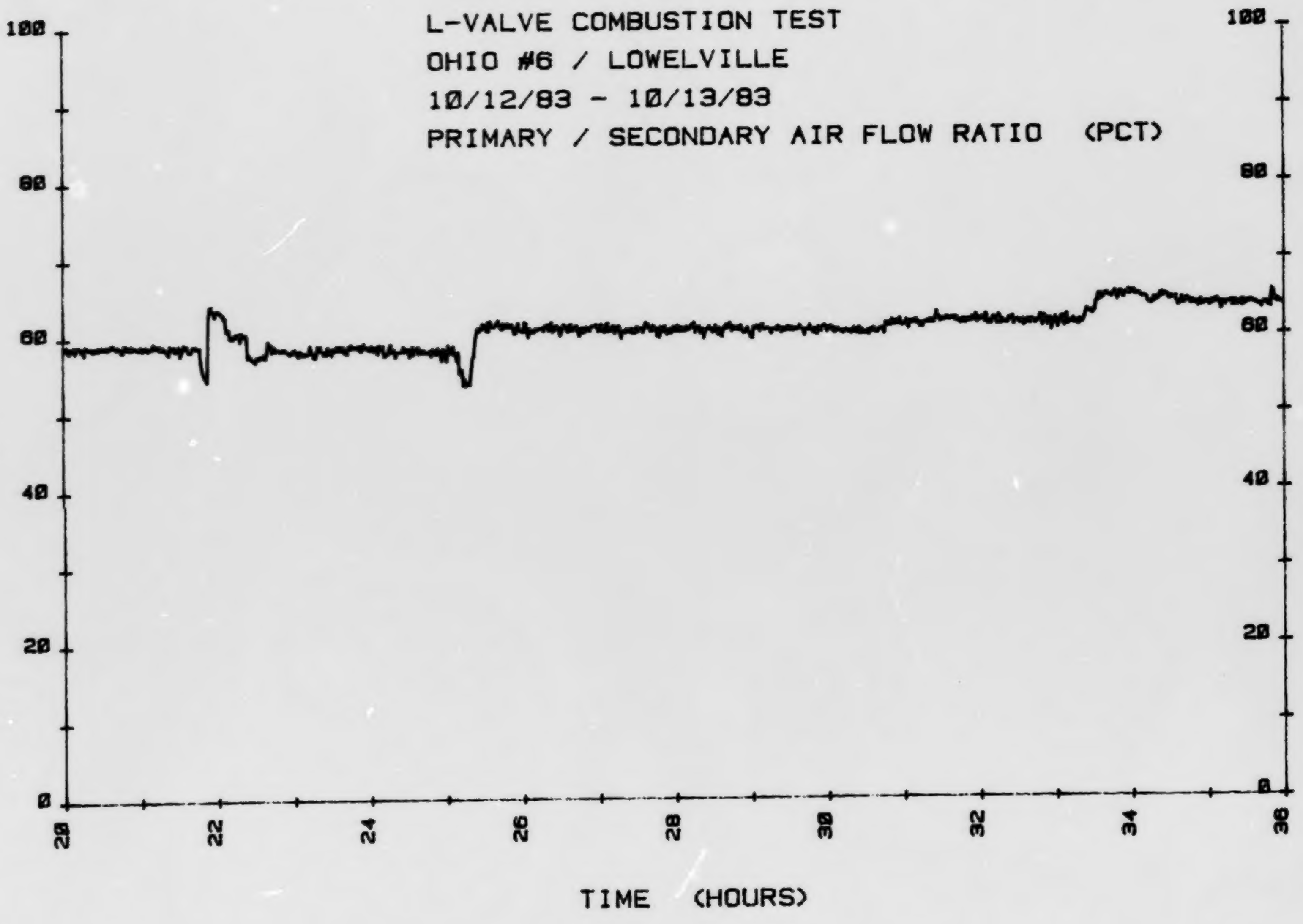


FIGURE B-27 Hot Test #1

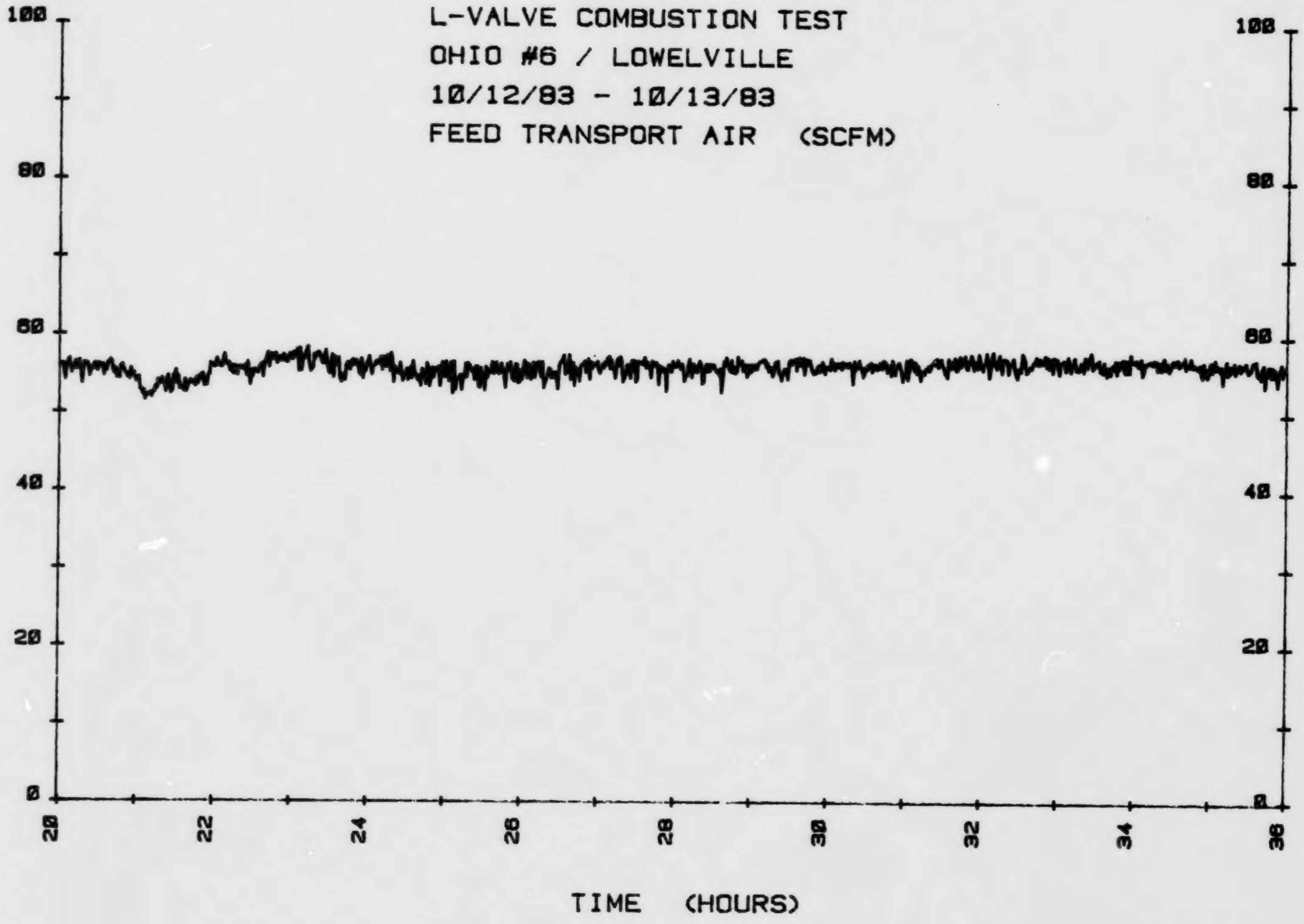


FIGURE B-28 Hot Test #1

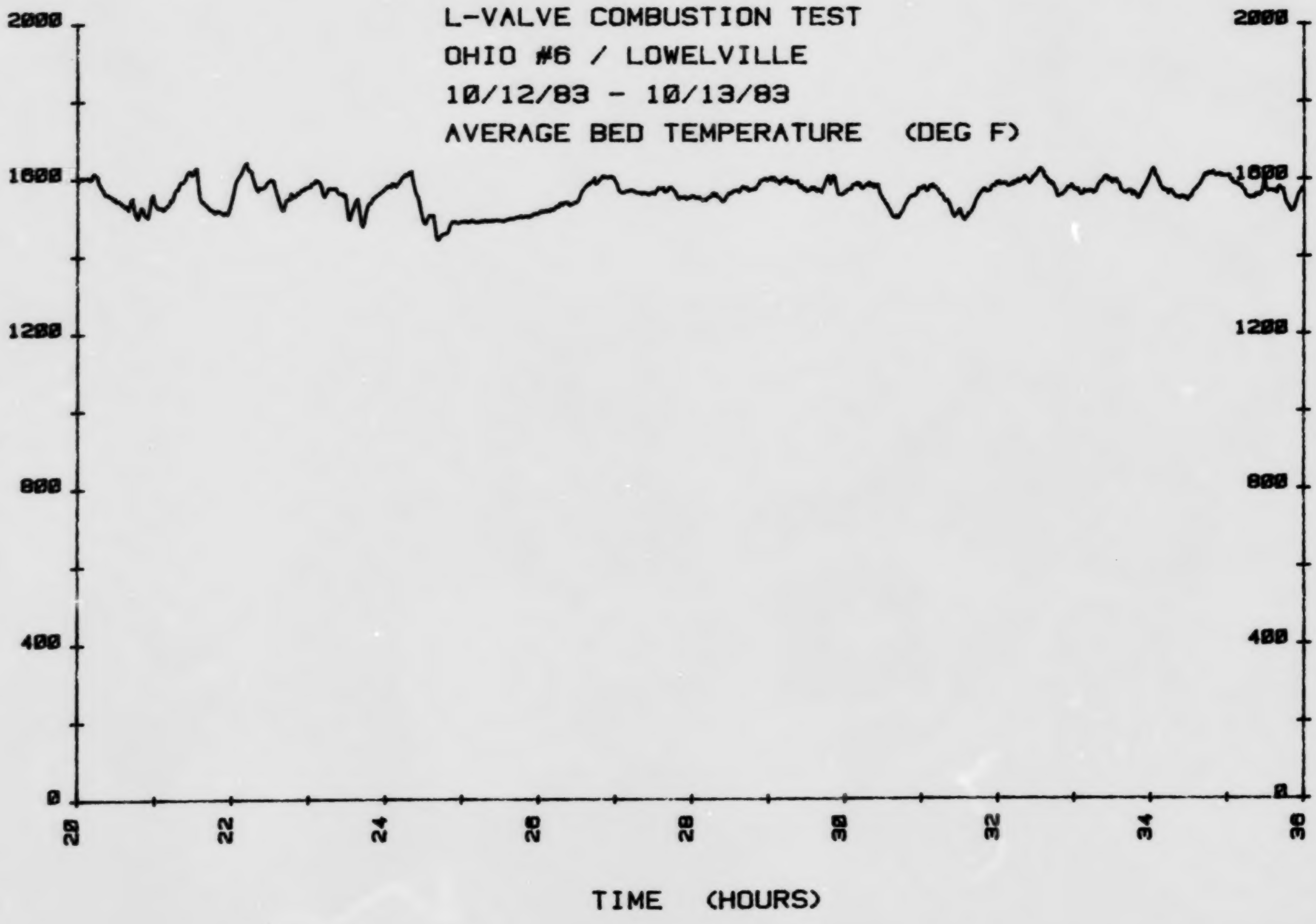


Figure B-29   Hot Test Run #3

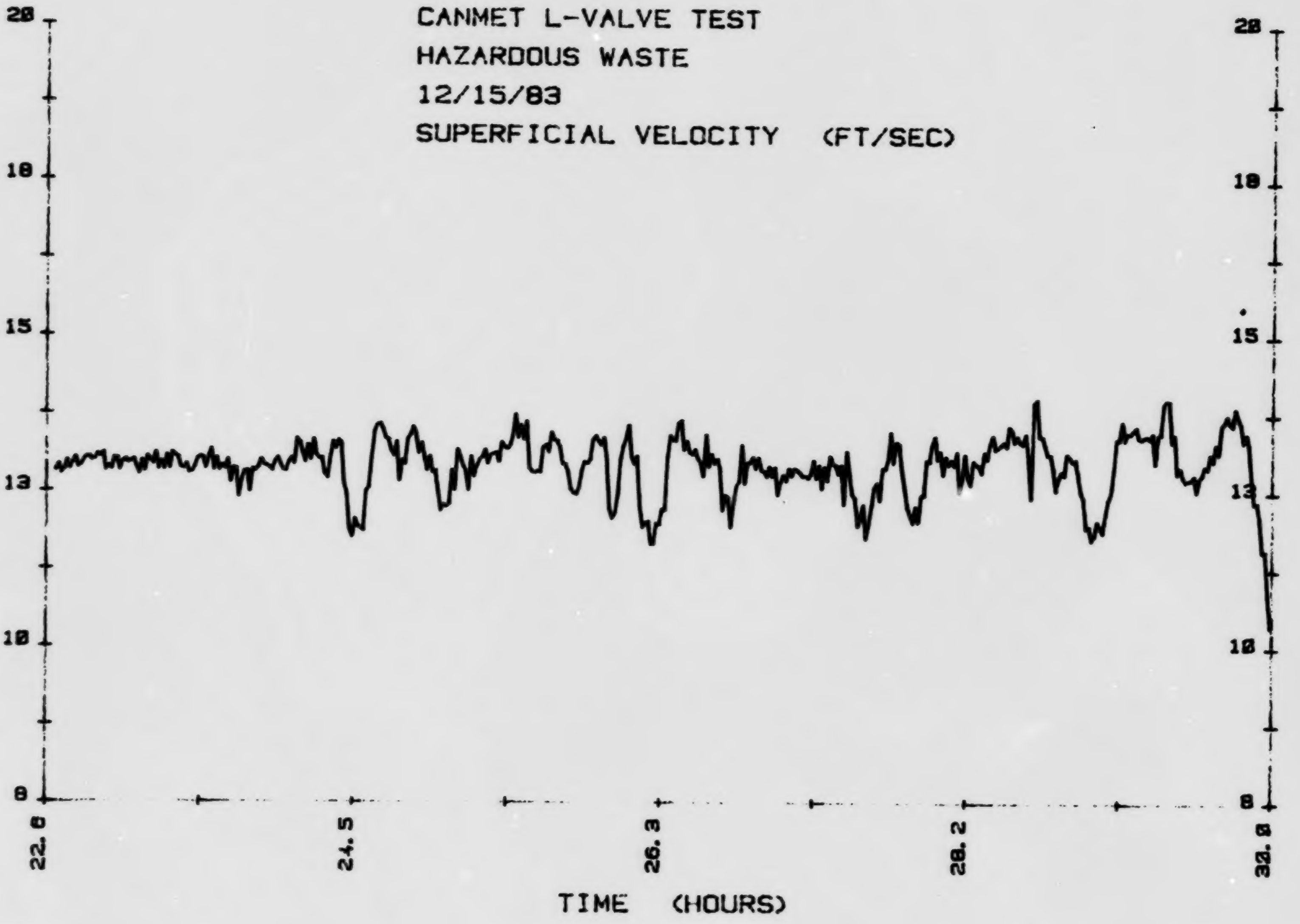


Figure B-30 Hot Test Run #3

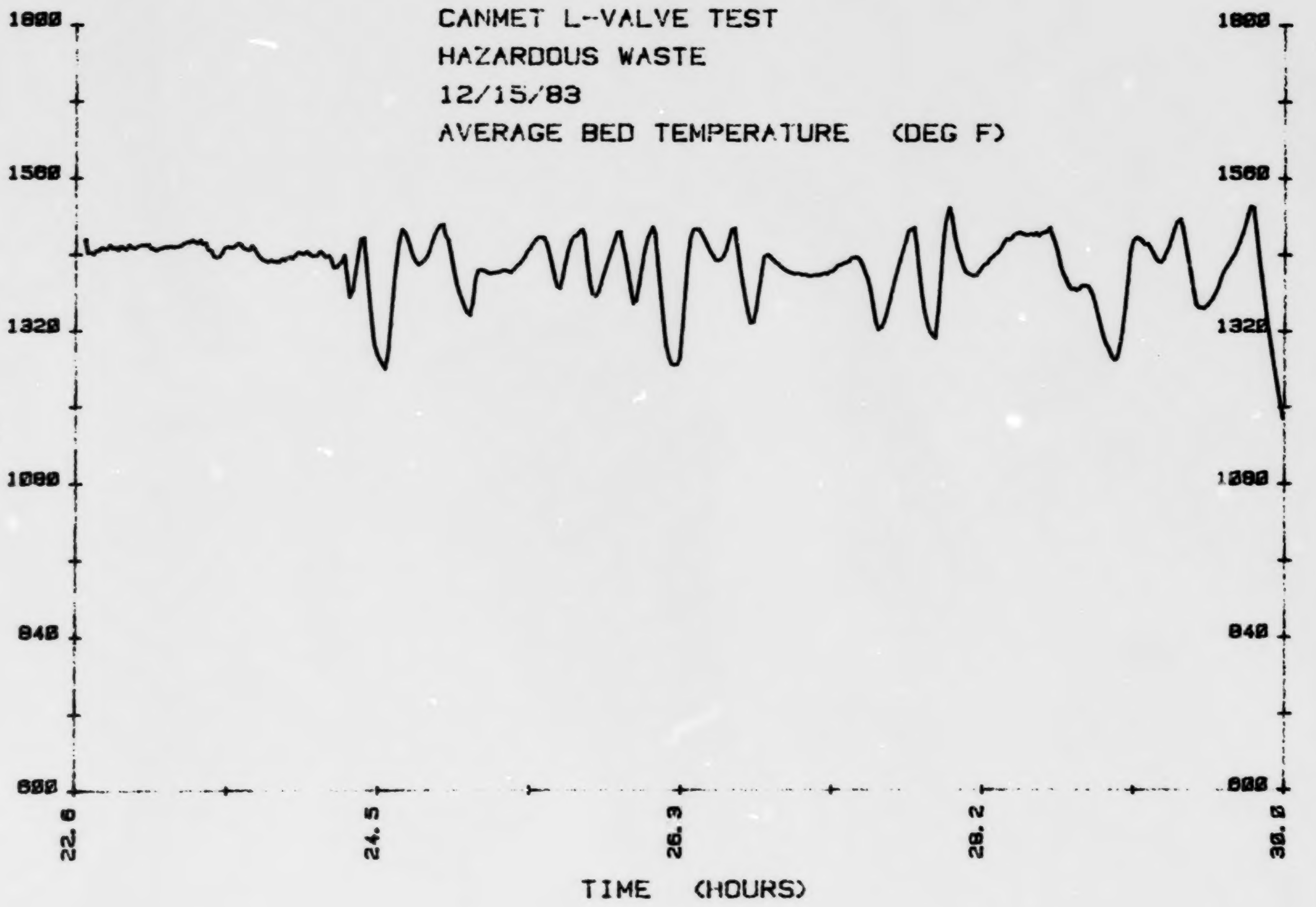


Figure B-31 Hot Test Run #3

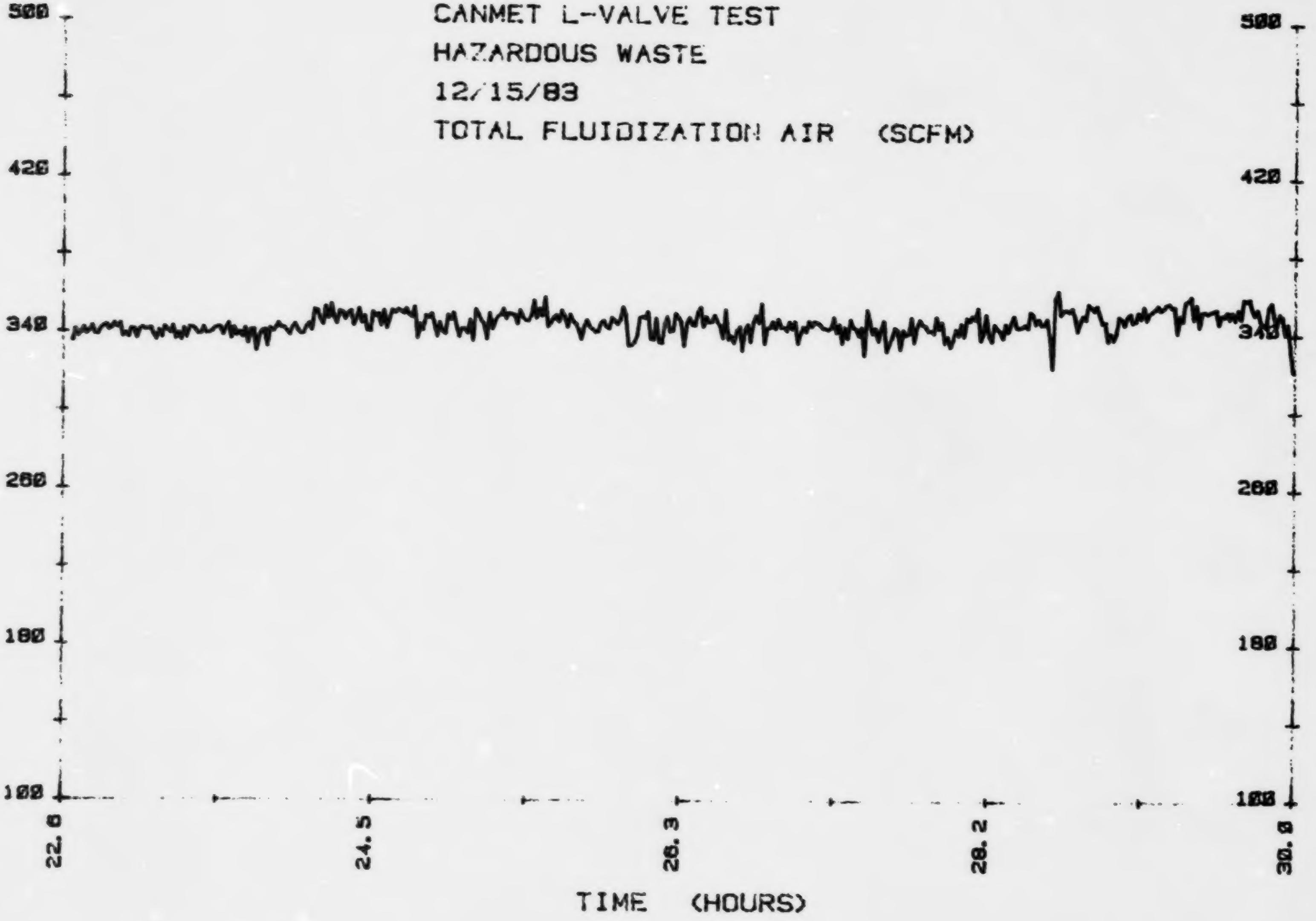

CANMET L-VALVE TEST
HAZARDOUS WASTE
12/15/83
TOTAL FLUIDIZATION AIR (SCFM)

Figure B-32 Hot Test Run #3

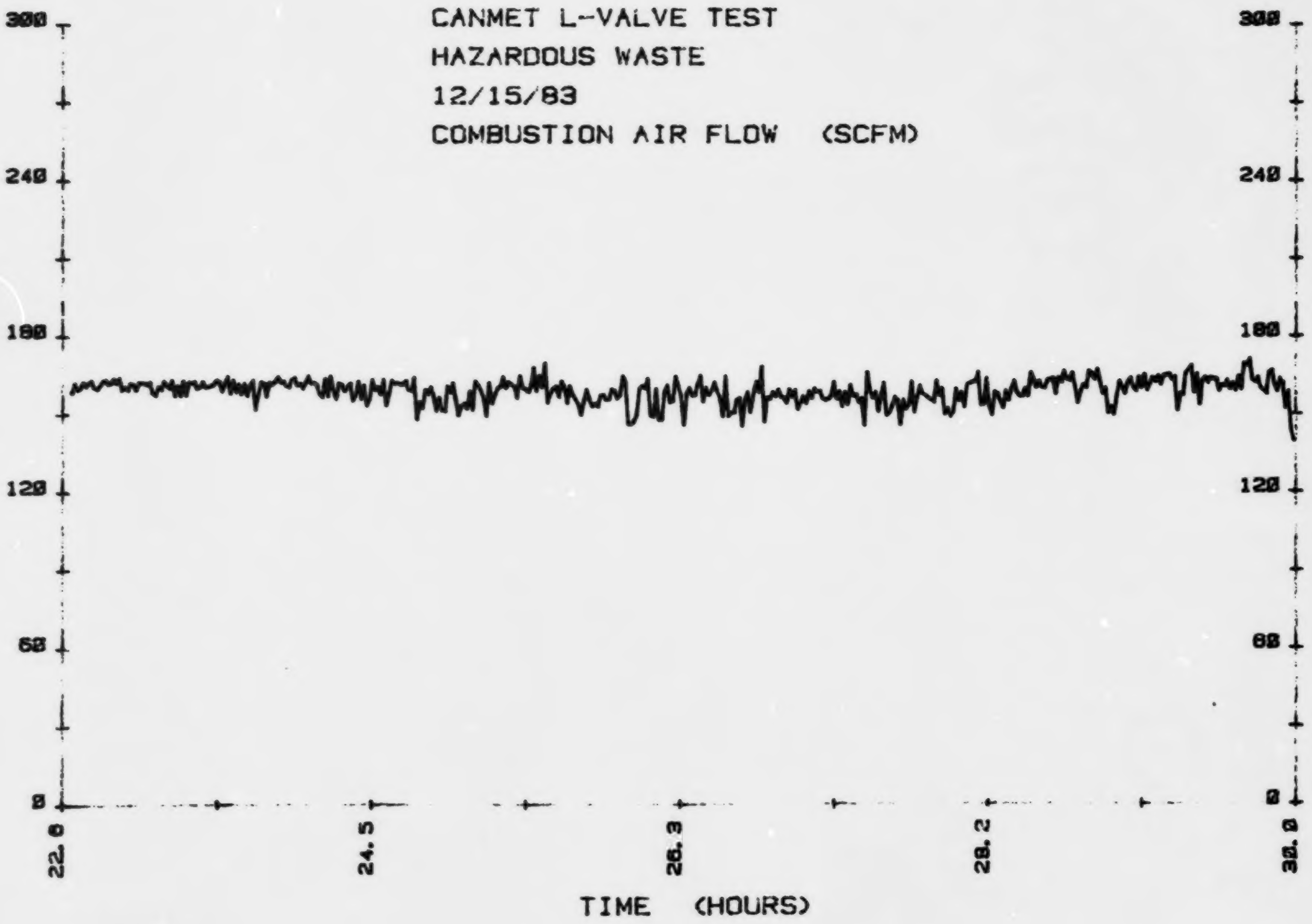


Figure B-34 Hot Test Run #3

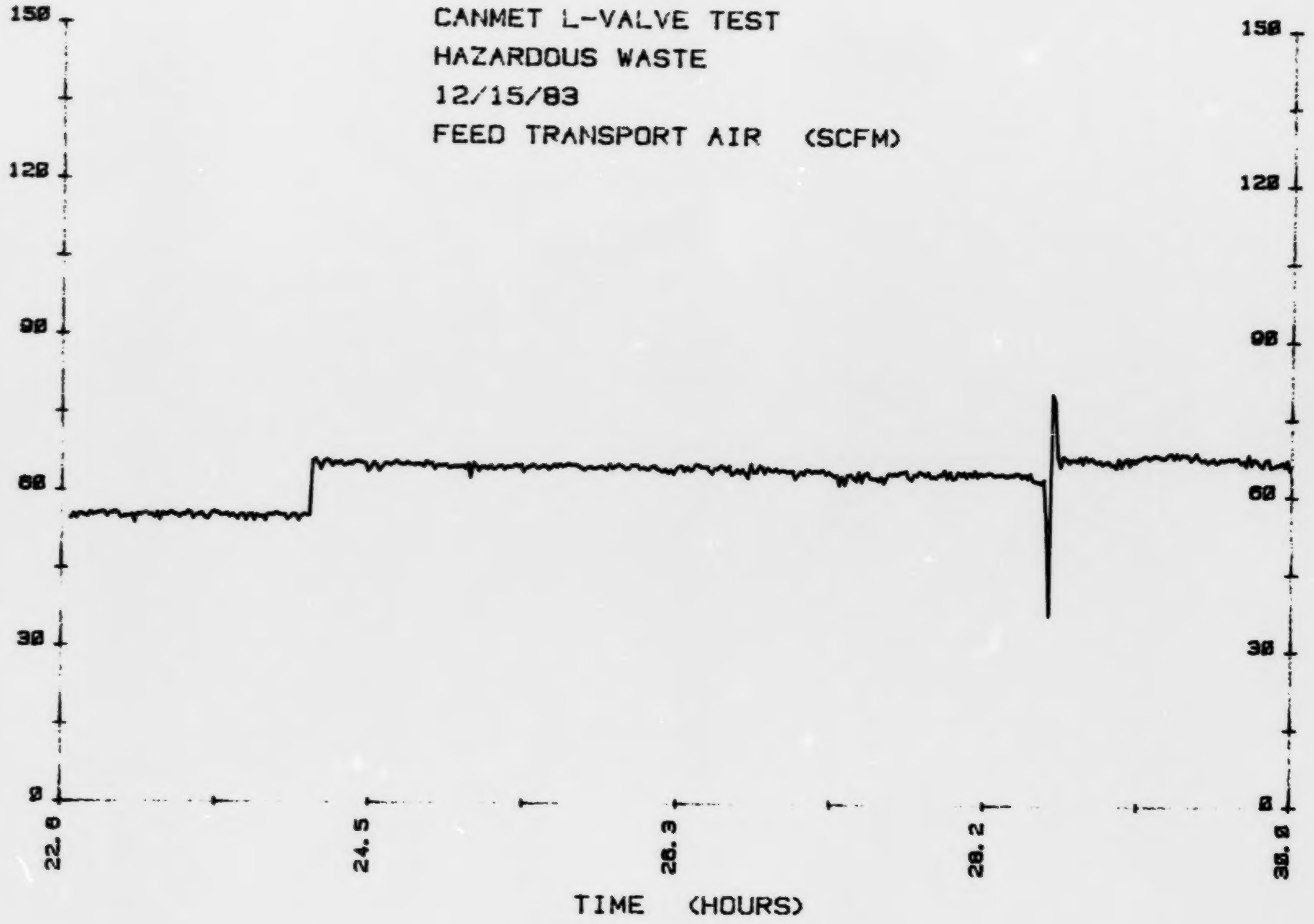
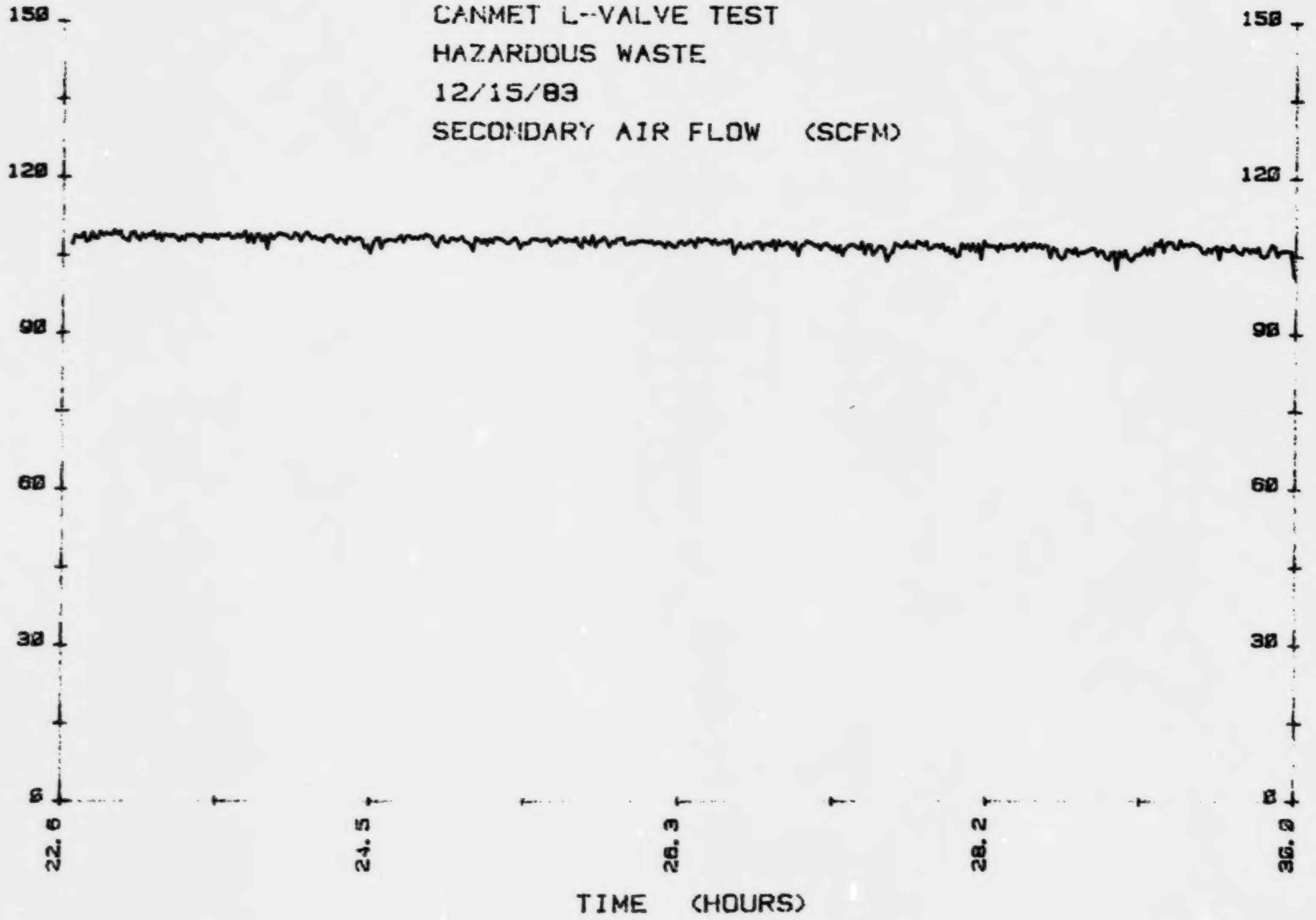


Figure B-33 Hot Test Run #3



5.

RECOMMENDATION

5. Recommendation

The reference design for the CANMET recirculating fluidized bed combustor shall be a self regulating Inclined L-valve with minimum aeration air flows (between 6 to 10 scfm) and designed with a minimum 7 ft stand pipe leg height. The critical aeration location is at #4 tap in Figure B-7, but additional aeration taps should be installed. Pressure taps to monitor standpipe performance shall be provided to alarm operator of stand pipe blockage if height exceeds 5 feet.

APPENDIX IV

VENDOR PROPOSAL COMPARISON SHEETS

SOLE SOURCE
BASIS FOR ESTIMATE

Nº	111-1 COMBUSTOR	G.A. TECHNOLOGIES			

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

Intercontinental Engineering Ltd

BID COMPARISON
COMBUSTOR

B

111-1

BASIS FOR ESTIMATE

Nº	121-1 FORCED DRAFT BLOWER	CROCKER EQUIPMENT SALES	PUMPS AND POWER	P.J. HANNAH	
	MANUFACTURER	AERZEN	SUTORBILT	GARDNER DENVER	
	MODEL	GMa 13F7	SERIES 4500, MODEL 711	7CD11	
	TYPE	ROTARY LOBE	ROTARY LOBE	HELICAL SCREW	
	AIR DISCHARGE TEMP.	111°C	N/A	171°C	
	BLOWER SPEED	2640 RPM	1589 RPM	2424 RPM	
	SUCTION CONNECTION	150 mm ϕ	200 mm ϕ	125 mm ϕ	
	DISCHARGE "	150 mm ϕ	200 mm ϕ	125 mm ϕ	
	NOISE LEVEL	76 dBA	N/A	84 dBA	
	DRIVE	56 kW	56 kW	56 kW	
	WEIGHT	740 kg (BLOWER ONLY)	358 kg (BLOWER ONLY)	N/A	
	REMARKS		0.14 Sm³/s FAN REQ'D FOR ACOUSTIC ENCLOSURE (INCL.)	NO ACOUSTIC ENCLOSURE REQ'D.	
	COST FOR VARIABLE SPEED DRIVE OPTION.	22,995	20,076 (NOT AS SPECIFIED)	N/A	
	DELIVERY	12 WKS.	12-14 WKS.	8-9 WKS. FROM DRWGS.	
	COST DATA:				
	BASE	16,932	19,668	24,760	
	DUTY	968 (12.1% OF 8,000)	INCL.	INCL.	
	FST (9%)	1,611	1,770	2,228	
	FREIGHT	300	500 (EST.)	1,115	
	TOTAL COST (EXCLUDES VARIABLE SPEED DRIVE OPTION)	19,811 ←	21,938	28,103	

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

Integ
Intercontinental Engineering Ltd

BID COMPARISON
FORCED DRAFT BLOWER

B

121-1

BASIS FOR ESTIMATE

Nº	131-1 IGNITION BURNER	TRECAN	FLECK BROTHERS	INPROHEAT	
	MANUFACTURER	TRECAN	PYRONICS	PYRONICS	
	MODEL	HV 320	NM 1501	NM 1001	
	FLAME LENGTH	300 mm	600 mm	400 mm	
	REQ'D AIR PRESSURE, NORM.	6 kPa	3.38 kPa	2.5 kPa	
	MAX.	70 kPa	4.23 kPa	N/A	
	MOUNTING FLANGE SIZE	308 mm DIA.	330 mm DIA.	216mm DIA. ←	
	COMBUSTOR BACKPRESSURE	52 kPa(g) MAX.	52 kPa (g) MAX.	27.6 kPa (g) MAX. ←	
	REMARKS			THIS PROPOSAL REC'D. AFTER THE OTHERS. THE VENDOR WAS INSTRUCTED TO SELECT A LOWER BACKPRESSURE UNIT.	
	DELIVERY	16 WKS.	8 WKS.	12 WKS.	
	FOB	MISSISSAUGA	VANCOUVER	VANCOUVER	
	COST DATA:				
	BASE	22,100	11,245	9,310	
	DUTY	NIL	NIL	NIL	
	FST (9%)	1,989	1,011	838	
	FREIGHT	125	INCL.	400 (EST.)	
	TOTAL COST	24,214	12,256	10,548 ←	

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BID COMPARISON
IGNITION BURNER

B 131-1

BASIS FOR ESTIMATE

Nº	141-1 BED DRAIN COOLER	JOY / DENVER	BETHLEHEM CORP.		
	MANUFACTURER	DENVER EQUIPMENT	BETHLEHEM		
	MODEL	5710-4 HOF HOLOFLITE	MODEL 1015343		
	THERMAL DUTY	49 kW	36 kW		
	WATER FLOW	0.5 kg/s	0.233 kg/s		
	SCREW DIAMETER	178 mm	254 mm		
	OVERALL HEIGHT	335 mm	483 mm ←		
	LENGTH (INLET TO OUTLET)	2826 mm	1077 mm ←		
	CONNECTION SIZES:				
	ASH INLET	302 × 200 mm	75 mm DIA.		
	ASH OUTLET	152 × 159 mm	75 mm DIA.		
	WATER INLET	1/2" NPT	1" NPT		
	WATER OUTLET	1" NPT	1" NPT		
	WEIGHT	764 kg	720 kg		
	DRIVE	0.38 kW DC	N/A		
	REMARKS		THIS UNIT WILL		
			RESULT IN HIGHER		
			COMBUSTOR (+475mm)		
	DELIVERY	6 MO.	4 MO.		
	FOB	COLORADO SPRINGS	SAN FRANCISCO		
	COST DATA:				
	BASE	34,662	29,800		
	EXCHANGE ($US = 1.33 CDN)	11,438	9,834		
	DUTY	5,255 (11.4% OF 46,100)	4,416 (11.4% OF 39,634)		
	FREIGHT	510	1,500		
	TOTAL COST	51,865 ←	45,550		

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BID COMPARISON
BED DRAIN COOLER

B

141-1

Nº	151-1 BAYONET TUBE HEAT EXCHANGER	G.A. TECHNOLOGIES			
		SOLE SOURCE			
	COST DATA	INCLUDED WITH			
		111-1			

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BAYONET TUBE HEAT EXCHANGER
B
151-1

BASIS FOR ESTIMATE

Nº	152-1 FLUE GAS COOLER	EBCO INDUSTRIES	ELLETT COPPER AND BRASS	INDUSTRIAL COMBUSTION AND EQUIPMENT	NEPTUNE DYNAMICS
	MANUFACTURER	EBCO	ELLETT	IC & E	MUELLER
	TYPE	RECTANGULAR TUBESHEET	U TUBE, F STYLE SHELL	U TUBE	PLATE EXCHANGER
	THERMAL DUTY	382 kW	N/A	473 kW	277 kW
	WATER FLOW NORMAL	1.57 kg/s	"	N/A	1.83 kg/s
	DESIGN	2.46 kg/s	"	3.13 kg/s	1.83 kg/s ←
	SURFACE AREA	N/A	4.1 m²	7.8 m²	N/A
	PRESSURE DROP - TUBE SIDE	15.3 kPa (DESIGN)	N/A	N/A	"
	SHELL SIDE	2.03 kPa	"	"	"
	MATERIALS - TUBES	A214 CS.	CS.	C.S.	304 SS.
	SHELL	A516-70 C.S.	C.S. (INTERIOR LINED)	NOT PROVIDED	N/A (ASSUME C.S.)
	EXCHANGER CONFIGURATION	3 TUBESHEETS IN 1	CYLINDRICAL SHELL	U TUBE EXCHANGER	7 PLATE EXCHANGERS
		CASING	AND TUBE.	TO PLACE IN DUCT	IN RECTANGULAR CASING
	EXCHANGER DIMENSIONS	254 x 432 x 914 mm L	610 mm Φ x 3960 mm L	610 x 610 x 1524 mm L	610 x 480 x 3960 L mm
	SURFACE ISOLATION	33 OR 67 %	N/A (ASSUME 0)	N/A (ASSUME 0)	43%
	WEIGHT	553 kg	N/A	N/A	N/A
	REMARKS	GOOD TECHNICAL	NO PERFORMANCE	NOT GOOD APPROACH	BEST TECHNICAL
		APPROACH BUT	DATA PROVIDED		OFFERING - QUESTION
		INSUFFICIENT INFO.			DESIGN RATING.
	DELIVERY	12-14 WKS.	N/A	12-14 WKS (FROM DRWGS)	6 WKS (FROM DRWGS)
	FOB	RICHMOND, BC.	PORT COQUITLAM, BC	DORVAL	VANCOUVER
	COST DATA:				
	BASE	11,700	30,000 (BUDGET)	7,900	11,910
	DUTY	NIL	NIL	NIL.	INCL.
	FST (9%)	1,053	2,700	711	1,072
	FREIGHT	400	500 (EST.)	200	INCL.
	TOTAL COST	13,153	33,200	8,811	12,982 ←

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BID COMPARISON
FLUE GAS COOLER

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152-1

BASIS FOR ESTIMATE

Nº	153-1 WATER COOLING SYSTEM		G.R. HUDSON SALES BASE	G.R. HUDSON SALES ALTERNATIVE 1	G.R. HUDSON SALES ALTERNATIVE 2	DEHN ENGINEERING ALTERNATIVE 3
	MANUFACTURER		BALTIMORE AIRCOIL (BAC)	BAC	BAC	YOUNG RADIATOR
	TYPE		OPEN COOLING TOWER	OPEN COOLING TOWER	CLOSED CIRCUIT COOLING	AIR COOLER
			WITH EXTERNAL HX	WITH EXTERNAL HX	TOWER (HX INCL)	(NON-EVAPORATIVE)
	MODEL -	TOWER	VXT-185	VXT-135	VXI-105-1X	HC-1807
		HX	HK-8-14-3-1A	HK-8-14-2-1C	-	-
	THERMAL DUTY		1124 kW ←	1047 kW	1047 kW	1047 kW
	WATER FLOW -	TOWER	12.866 kg/s	16.273 kg/s	28.901. kg/s	-
		HX	7.438 kg/s ←	6.911 kg/s	6.911 kg/s	6.911 kg/s
	TOWER AIR FLOW		17.0 m³/s	12.5 m³/s	34 m³/s	52.2 m³/s
	TOWER FAN DRIVE		22 kW	15 kW	30 kW	2 @ 19 kW
	DIMENSIONS -	TOWER	5.2 m H × 3.7 m L × 1.4 m	3.4 m H × 3.7 m L × 1.2 m	3.4 m H × 4.0 m L × 2.4 m	2.7 m × 5.8 m × 2.6 m
		HX	1.5 m H × 5 m L × 0.4 m	1.4 m H × 5 m L × 0.8 m	-	-
	WEIGHTS -	TOWER	2503 kg	1637 kg	8,562 kg	5,442 kg.
		HX	3515. kg	2372 kg	-	-
	REMARKS		CIRCULATING WATER	RATED AT 26.7C db,	RATED AT 30C db, 23C wb	RATED AT 26.7C db.
			FLOW AS ORIGINALLY	22.2C wb. FOR DIRECT	FOR DIRECT COMPARISON	22.2C wb.
			SPECIFIED - SUBSEQUENTLY	COMPARISON TO ALT. 3	TO BASE ALTERNATIVE	WILL NOT MAINTAIN
			CHANGED TO 6.911 kg/s.			LOAD AGAINST
			RATED AT 30C db,			RISING AMBIENT TEMP.
			23C wb. —— THESE	UNITS INCLUDE BALTIBOND	CORROSION ——	
				PROTECTION.		
	DELIVERY		3½ MO.	3½ MO.	3½ MO.	15 WKS.
	FOB		GEORGETOWN, ONT			RACINE, WISC.
	COST DATA:					
	BASE		24,260	20,460	32,000	40,480 US
	EXCHANGE		-	-	-	13,332 (@ 33%)
	DUTY		-	-	-	6,931 (12.9%)
	FST (9%)		2,178	1,841	2,880	5,460
	FREIGHT		1,700	INCL	INCL.	1,500
	TOTAL COST		28,078 ←	22,301	34,880	67,623.

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BID COMPARISON
COOLING WATER SYSTEM

B

153-1

BASIS FOR ESTIMATE

Nº	153-2 COOLING WATER PUMPS	FLECK BROTHERS	W.F. KEENAN	B & D ENGINEERING SALES	
	MANUFACTURER	WORTHINGTON	CANADA PUMPS	GOULDS	
1.	CIRCULATING PUMP:				
	MODEL	TYPE D-814, SIZE 2½×1½×8	3½×1½×9 CRO	3196 ST 1×1½×8	
	RPM	3500	3500	3500	
	DRIVE	11 kW	11 kW	11 kW	
	WEIGHT	277 kg	290 kg	220 kg	
2	COOLING TOWER PUMP				
	MODEL	TYPE D-814, SIZE 4×3×8	4×3×11 CRO	3196 MT 3×4×8	
	RPM	1750	1750	1750	
	DRIVE	5.6 kW	5.6 kW	5.6 kW	
	WEIGHT	397 kg	308 kg	250 kg	
	DELIVERY	6-8 WKS.	1½ Mo.	2 Mo.	
	FOB		KITCHENER, ONT.	CAMBRIDGE, ONT.	
	COST DATA:				
	BASE	3,387	3,888	4,819	
	FST (9%)	305	350	434	
	FREIGHT	INCL	317	155	
	TOTAL COST	3,692 ←	4,555	5,408	

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BID COMPARISON
COOLING WATER PUMPS

B

153-2

BASIS FOR ESTIMATE

No	153-3 COOLING TOWER SUMP	W.A. THOM	EBCO INDUSTRIES	REGAL TANKS	
	SHELL MATERIAL	A-36 C.S.	T-304 S.S.	283 GRC	
	THICKNESS	4.8 mm	2.11 mm	4.8 mm	
	COATING	COAL TAR EPOXY	NONE	EPOXY MASTIC ←	
	WEIGHT	868 kg	466 kg	764 kg.	
	DELIVERY	3-4 Wks.	8 Wks.	3 Wks.	
	FOB	N. VANCOUVER	RICHMOND	SURREY	
	COST DATA:				
	BASE	3,695	7,482	3,618	
	PST (9%)	333	673	326	
	FREIGHT	1,000 (EST.)	750 (EST)	660	
	TOTAL COST	5,028 ←	8,905	4,604	

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BID COMPARISON
COOLING TOWER SUMP

B 153-3

BASIS FOR ESTIMATE

161-1 BAGHOUSE	McCARTHY & ROBINSON	JOY MANUFACTURING	DUCON - MIKROPUL	
MANUFACTURER	SLY	JOY	DUCON - MIKROPUL	
MODEL	PACTECON PC-104	PULSEFLO PF² 6004-56	MIKROPULSAIRE 64S-4-20	
FILTER MATERIAL	NOMEX	TEFLON COATED FIBERGLAS	NOMEX	
FILTER AREA	33 m²	33 m²	28 m²	
FILTER ACCESS	SIDE	SIDE	SIDE	
TEMPERATURE LIMIT	177°C	260°C ←	215°C	
OVERALL DIMENSIONS (L×W×H)	1,334 × 1,638 × 1,944 mm	1,676 × 1,473 × 2,591 mm	1,473 × 1,473 × 2,337 mm	
CONNECTION SIZE: INLET	152 × 610 mm	200 mm ⌀	AS REQ'D	
OUTLET	241 × 368 mm	150 × 300 mm	AS REQ'D	
HOPPER	200 mm SQUARE	100 mm ⌀	AS REQ'D	
COMPRESSED AIR REQ'D.	N/A	11.2 SCFM @ 75 PSIG	4.8 SCFM @ 100 PSIG	
WEIGHT	1525 kg	1000 kg	728 kg	
REMARKS	INLET GAS TEMP. REDUCED TO 177°C BY BLEND AIR DAMPER. (WOULD REQUIRE LARGER I.D. FAN)	CAN SELECT 1 OR 2 HOPPERS - PRICE BASED ON 1 HOPPER		
DELIVERY	8-10 Wks.	12 Wks	1½ - 2 Mo.	
FOB		MONTREAL		
COST DATA:				
BASE	13,354	9,850	8,990	
DUTY	1,049 (12.1% of 8,666)	-	-	
FST (9%)	1,296	887	809	
FREIGHT	INCL.	250	300	
TOTAL COST	15,699	10,987 ←	10,099	

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BID COMPARISON
BAGHOUSE

161-1

BASIS FOR ESTIMATE

161-2 FLYASH RECYCLE ROTARY VALVE	FIRING INDUSTRIES	DUCON - MIKROPUL		
MANUFACTURER	PREMIER PNEUMATICS	DUCON - MIKROPUL		
MODEL	MDRFS-76-10H-1P	4" PERMA/FLO TYPE B		
DIMENSIONS: OPENING	150 mm ɸ	100 mm ɸ		
HEIGHT	230 mm	600 mm		
MAX. PRESSURE DIFFERENTIAL	N/A	103 kPa ←		
DRIVE	0.38 kW DC	0.38 kW DC		
WEIGHT	N/A	182 KW		
REMARKS	DRIVE NOT AS SPEC'D.	INCLUDES ADDITIONAL WYE FITTING TO VENT BLOWBACK.		
DELIVERY	6-8 Wks.	8-10 Wks.		
FOB				
COST DATA:				
BASE	3,900	6,902		
DUTY	-	-		
FST (9%)	351	621		
FREIGHT	INCL	200		
TOTAL COST	4,251	7,723. ←		

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BID COMPARISON
FLYASH RECYCLE ROTARY VALVE
B
161-2

BASIS FOR ESTIMATE

No	171-1 INDUCED DRAFT FAN		OLYMPIC INTERNATIONAL AGENCIES	BECKLAND EQUIPMENT		
	MANUFACTURER		NORTHERN BLOWER	JOY		
	MODEL		DESIGN 55 - SIZE 2T-15-32	275-10 DESIGN 5B ABST8		
	RPM		3540	3550		
	CONNECTIONS	SUCTION	254 mm ϕ	254 mm ϕ		
		DISCHARGE	305 mm ϕ	254 mm ϕ		
	DRIVE		15 kW	19 kW		
	WEIGHT		650 kg	660 kg		
	REMARKS		SILENCERS NOT INCL.	INLET & OUTLET		
			93 dBA NOISE LEVEL	SILENCERS INCL. ←		
	DELIVERY		10 Wks.	12-14 Wks.		
	FOB		WINNIPEG	WINNIPEG		
	COST DATA:					
	BASE		4,820	8,225		
	DUTY		-	-		
	FST		434	740		
	FREIGHT		260	145		
	TOTAL COST		5,514	9,110 ←		

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BID COMPARISON
INDUCED DRAFT FAN

B

171-1

BASIS FOR ESTIMATE

NO	172-1 STACK		DIAMOND LUFTEK CONSTRUCTION			
	MANUFACTURER		AS ABOVE			
	OUTER SHELL	DIA.	559 mm			
		THICKNESS	5 mm			
		MATERIAL	ASTM A-242			
	INNER SHELL	DIA.	309 mm			
		THICKNESS	5 mm			
		MATERIAL	ASTM A-242			
	GUY WIRE		6 mm ɸ GALVANIZED			
	SECTION LENGTH		12.5 m			
	WEIGHT		1400 kg			
	DELIVERY		8 WKS			
	FOB		-			
	COST DATA					
	BASE		13,860			
	DUTY		—			
	FST (9%)		1,247			
	FREIGHT		900			
	TOTAL COST		16,007 ←	SOLE RESPONSE		

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BID COMPARISON
STACK

B

172-1

BASIS FOR ESTIMATE

Nº	211-1 FUEL STORAGE AND METERING SYSTEM	MERRICK	F. DREXEL	J & M INDUSTRIAL SUPPLY	
	MANUFACTURER	VARIOUS	K-TRON	WALLACE & TIERNAN	
	FUEL BIN CAPACITY	3.117 m³	0.43 m³	APPROX. 1.5 m³	
	BIN DISCHARGER - MFGR.	VIBRANETICS MODEL BD4		W & T	
	DRIVE	1.5 KW AC		0.75 KW AC	
	WEIGHFEEDER - MFGR	MERRICK	K-TRON LWF	W & T	
	MODEL	950 DSC-1	T-35 TWIN SCREW	31-160 MC	
	DRIVE	0.19 KW DC		N/A	
	TOTAL WEIGHT	1400 kg			
	REMARKS	0.75 kW AC ROTARY VALVE ADDED, BIN, WEIGHFEEDER NOT PRESSURIZED.	NOT TECHNICALLY COMPLIANT. 1 UNIT CANNOT HANDLE ALL FUELS - 2 PROPOSED.	LITTLE INFORMATION	
	DELIVERY	4 Mo.		4 Mo.	
	FOB	PETERBOROUGH			
	COST DATA				
	BASE	36,096	68,758	41,500	
	DUTY	-	-	-	
	FST (9%)	3,249	6,188	3,735	
	FREIGHT	600	500 (EST)	400	
	TOTAL COST	39,945 ←	75,446	45,635	

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BID COMPARISON
FUEL STORAGE & METERING.

B 211-1

BASIS FOR ESTIMATE

SHEET 1/2

Nº	212-1 BUCKET ELEVATOR		STEPHENS-ADAMSON	REXNORD	WARD IRONWORKS	JERVIS B. WEBB
	MANUFACTURER		S.-A.	REXNORD	W. I.	J. B. W.
	MODEL		SB-064-A	1206	MODEL E	N/A
	HEIGHT	TOTAL	9,342 mm	10,185 mm	9,340 mm	9,340 mm
		DISCHARGE	8350 mm	8,534 mm	8,528 mm	7,298 mm
	CASING SIZE		286 x 845 mm	356 x 1245 mm	305 x 559 mm	400 x 1,220 mm
	CAPACITY		8 m³/h	8.5 m³/h	12 m³/h	30 m³/h
	DRIVE		0.75 kW EXPF.	1.12 kW EXPF	1.12 kW TEFC	2.24 kW EXPF.
	WEIGHT		1,210 kg	1,361 kg		
	REMARKS					400 x 1,220 mm BOOT SECTION MOUNTED IN 1,000 mm PIT BELOW FLOOR LEVEL.
	DELIVERY		4 Mo.	3½ - 4 Mo.	2 Mo.	3 Mo.
	FOB		BELLEVIEW, ONT		WELLAND, ONT.	HAMILTON, ONT.
	COST DATA:					
	BASE		11,100	14,260	8,370	13,000
	DUTY		—	-	-	-
	FST (9%)		999	1,283	753	1,170
	FREIGHT		230	220	270	305
	TOTAL COST		12,329 ⟵	15,763	9,363	14,475

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BID COMPARISON
BUCKET ELEVATOR (SHEET 1)
B
212-1

SHEET 2/2

No	212-1 BUCKET ELEVATOR		FMC			
	MANUFACTURER		FMC / LINK BELT			
	MODEL		TYPE 141			
	HEIGHT	TOTAL	9,328 mm			
		DISCHARGE	7,823 mm			
	CASING SIZE		298 × 889 mm			
	CAPACITY		7.98 m³/h			
	DRIVE		0.75 kW EXPF.			
	WEIGHT		1,362 kg			
	DELIVERY		4 Mo.			
	FOB					
	COST DATA:					
	BASE		9,963			
	DUTY		967 (11.4% of 8481)			
	FST (9%)		984			
	FREIGHT		1,040			
	TOTAL COST		12,954			

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BID COMPARISON
BUCKET ELEVATOR (SHEET 2)

B 212-1

BASIS FOR ESTIMATE

Nº	221-1 LIMESTONE STORAGE AND METERING SYSTEM		MERRICK	F DREXEL	J&M INDUSTRIAL SUPPLY	
	MANUFACTURER		VARIOUS	(NON-COMPLIANT)	WALLACE AND TIERNAN	
	BIN CAPACITY		1 m³	0.07 m³	1 m³	
	BIN DISCHARGER	MFGR.	24" VIBRANETICS MODEL BD-2		W&T MODEL 305	
		DRIVE	0.75 kW AC		N/A	
	WEIGHFEEDER	MFGR.	MERRICK		W&T	
		MODEL	951- DSC-1		31-160 RC	
		DRIVE	0.19 kW AC EXPF.		0.19 kW DC	
	PREFEEDER	MFGR	MERRICK	K-TRON	INTEGRAL WITH	
		MODEL	MCF 1900-B	S-200 SCREW FEEDER	WEIGHFEEDER	
		DRIVE	0.38 kW DC		N/A	
	REMARKS		ADD KICE MODEL			
			VB6x8 ROTARY			
			AIRLOCK			
	DELIVERY		4 Mo.	N/A	3½ Mo.	
	FOB		PETERBOROUGH			
	COST DATA :					
	BASE		30,437	39,920	33,500	
	DUTY		–	–	–	
	FST (9%)		2,739	3,593	3,015	
	FREIGHT		450	400 (EST.)	350	
	TOTAL COST		33,626 ←	43,913	36,865	

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BID COMPARISON
LIMESTONE STORAGE & METERING

B | 221-1

BASIS FOR ESTIMATE

Nº	222-1 PNEUMATIC CONVEYING SYSTEM		DUCON- MIKROPUL	FIRING INDUSTRIES		
	BLOWER	MFGR.	ROBUS	PREMIER PNEUMATICS		
		MODEL	AIR-VAC RVT-60			
		DRIVE	5.6 KW AC	3.7 KW		
	CYCLONE	MFGR.	DUCON- MIKROPUL			
		MODEL	CR-24			
	ROTARY AIRLOCK	MFGR/MODEL	6" PERMAFLO TYPE B			
		DRIVE	0.38 KW AC			
	HEIGHT OF CYCLONE + AIRLOCK		1,778 mm			
	PIPING SIZE		75 mm	50 mm		
	WEIGHT	BLOWER	444 kg + DRIVE			
		CYCLONE + AIRLOCK	400 kg + DRIVE			
	REMARKS:		DRIVES NOT INCLUDED: EXTRA FOR: 5.6 KW - 407 0.38 KW - 167 TOTAL 574	NO TECHNICAL DATA		
	DELIVERY		8-10 WKS FROM DRWGS	N/A		
	COST DATA:					
	BASE		16,040	20,000 (BUDGET)		
	EXTRAS		574	-		
	FST (9%)		1,495	1,800		
	FREIGHT		600	500 (EST.)		
	TOTAL COST		18,709 ←	22,300		

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BID COMPARISON
PNEUMATIC CONVEYING SYSTEM

B 222-1

BASIS FOR ESTIMATE

Nº	231-1 PORTABLE HOPPERS	ALPINE STEEL	BURRARD YARROWS		
1	BUCKET ELEVATOR HOPPER:				
	CAPACITY	$0.73\ m^3$	$0.67\ m^3$		
	WALL THICKNESS	6 mm A36	3 mm AISI 1010		
	WEIGHT	721 kg	205 kg		
2.	FUEL BIN HOPPER:				
	CAPACITY	$0.46\ m^3$	$0.56\ m^3$		
	WALL THICKNESS	6 mm	3 mm		
	WEIGHT	558 kg	180 kg		
3	SAND HOPPER:				
	CAPACITY	$0.16\ m^3$	0.13 kg		
	WALL THICKNESS	6 mm	3 mm		
	WEIGHT	224 kg	90 kg		
	DELIVERY	3 Mo.	3 Wk		
	FOB	VANCOUVER	VICTORIA		
	COST DATA:				
	BASE	17,379	5,817		
	FST (9%)	1,564	524		
	FREIGHT	603	250		
	TOTAL COST	19,546	6591 ←		

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

BID COMPARISON
PORTABLE HOPPERS

B

231-1

BASIS FOR ESTIMATE

241-1 FUEL TRANSFER SCREW No. 1	FMC	SULLIVAN STRONG SCOTT	JERVIS B. WEBB	
MODEL/TYPE	6" SCREW CONVEYOR	14" DIA. U-TUBE	6" SCREW CONVEYOR	
SCREW DIAMETER	152 mm	356 mm	152 mm	
OVERALL LENGTH	2,621 mm	2,668 mm	2,388 mm	
MATERIAL: FLIGHTS	3.6 mm CS (10 GA.)	6 mm C.S.	6 mm C.S.	
SHAFT	50 mm SCH 40 PIPE	75 mm SCH 80 PIPE	50 mm SCH. 40 PIPE	
TROUGH	1.9 mm C.S. (14 GA.)	5 mm C.S.	3.4 mm C.S. (10 GA.)	
SPEED RANGE	TO 27 RPM	N/A	0.9 - 9.0 RPM	
DRIVE	0.38 kW (MOTOR N.I.C.)	3.7 kW DC	0.56 kW DC EXPF	
WEIGHT	179 kg + MOTOR	529 kg	230 kg	
REMARKS	- EXTRA COST FOR RELIANCE 0.38 kW V.S. DRIVE - 2,260 (INTEG ESTIMATE) - DUST TIGHT ONLY - 93°C MAX. SEALS - M+W WARRANTY ONLY		AIR TIGHT CONSTRUCTION NO STD. WARRANTY	
DELIVERY	3 Mo.	3 Mo. TORONTO	2 Mo.	
COST DATA				
BASE	3,797 + 2,260	18,855	9,986	
DUTY	366 (11.4% OF 3,208)	-	905 (12% OF 7,542)	
FST (9%)	573	1,697	980	
FREIGHT	245	200	142	
TOTAL COST	7,181	20,752	12,013	

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
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ARFBC RESEARCH FACILITY

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Intercontinental Engineering Ltd

BID COMPARISON
FUEL TRANSFER SCREW No. 1
B
241-1

BASIS FOR ESTIMATE

NO	241-2 FEED SYSTEM ROTARY VALVE	FIRING INDUSTRIES	DUCON- MIKROPUL		
	MANUFACTURER	PREMIER PNEUMATICS	D-M		
	MODEL	MDRFS-76-10H-1P	4" PERMA/FLO TYPE B		
	DIMENSIONS OPENING	150 mm ⌀	100 mm		
	HEIGHT	238 mm	400 mm		
	MAX. PRESSURE DIFFERENTIAL	N/A	(ASSUME ~ 100 kPa)		
	MAX. OPERATING TEMPERATURE	230 °C	650°C ←		
	DRIVE	0.38 kW DC	0.56 kW DC EXPF		
	WEIGHT	N/A	182 kg		
	REMARKS	SOME CONCERN ABOUT TEMPERATURE LIMITATION.			
	DELIVERY	1½ - 2 Mo.	2½ Mo.		
	FOB				
	COST DATA				
	BASE COST	4,500 (BUDGET)	7,302		
	FST (9%)	405	657		
	FREIGHT	200 (EST.)	200		
	TOTAL COST	5,105	8,159 ←		

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

BID COMPARISON
FEED SYSTEM ROTARY VALVE
B
241-2

BASIS FOR ESTIMATE

242-1 FUEL TRANSFER SCREW No. 2	CHRISTIAN ENGINEERING	SULLIVAN STRONG SCOTT	FMC	JERVIS B. WEBB
MODEL / TYPE	XNG VP FEEDER	12" TUBULAR SCREW CONV.	6" TUBULAR SCREW CONV.	6" TUBULAR SCREW CONV.
SCREW DIAMETER	152 mm	280 mm	152 mm	152 mm
OVERALL LENGTH	3,647 mm	3,963 mm	3,079 mm	3,600 mm
TROUGH O.D. AT JACKET END	230 mm ←	445 mm	254 mm	254 mm
MATERIAL: FLIGHTS	6 mm C.S./310 S.S.	5 mm CS/310 S.S.	3.6 mm C.S./310 S.S.	6 mm C.S./310 S.S.
SHAFT	50 mm C.S.	75 mm SCH 40 CS/310 SS	38 mm C.S./310 S.S.	50 mm SCH 40 CS/SS
TROUGH	3.4 mm C.S.	11 mm - 305 mm SCH40	1.9 mm C.S./310 S.S.	3.2 mm C.S./310 SS
COMBUSTOR FLANGE SIZE	N/A	445 mm	280 mm min.	305 mm (?)
SPEED RANGE	N/A	TO 38 RPM	TO 15 RPM	0.85 TO 4.2 RPM
TEMPERATURE LIMITATION	N/A	N/A	93°C	N/A
DRIVE	0.75 kW DC	5.6 kW DC	0.38 kW (MOTOR N/C)	0.56 kW DC
WEIGHT	839 kg	900 kg	207 kg + MOTOR	300 kg
REMARKS	OFFERS DESIGN ASSISTANCE IN PRICE - EXPERIENCED IN APPLICATION.		· EXTRA COST FOR DC DRIVE = 2,200. - TEMPERATURE LIMIT - LIMITED WARRANTY	- NO HALF PITCH SCREW - LAST SECTION DOUBLE FLIGHTED AND NO FLIGHTS LAST 254 mm. - AIR TIGHT TO 52 kPag. - NO STD. WARRANTY
DELIVERY	N/A	3 Mo.	3 Mo.	2 Mo.
COST DATA				
BASE	14,500	26,436	4,136 + 2,200 = 6,336	10,389
EXCHANGE	4,350	-	-	-
DUTY	2,282 (13% OF 17,550)	-	399 (11.4% OF 3,498)	935 (12% OF 7,791)
FST (9%)	1,902	2,379	606	1,019
FREIGHT	325	400	250	193
TOTAL COST	23,359 ←	29,215	7,591	12,536

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY; MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

integ

BID COMPARISON
FUEL TRANSFER SCREW NO. 2

B

242-1

Volume

2

ENERGY, MINES AND RESOURCES. CANADA
CANMET / CCRL

DESIGN OF AN ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTION RESEARCH FACILITY

Work on this project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources, Canada.

DSS FILE NUMBER : 15SQ.23440-2-9141
DSS CONTRACT SERIAL NUMBER : OSQ82-00224
CANMET SCIENTIFIC AUTHORITY : D. Desai

VOLUME II

APPENDIX V - EQUIPMENT SPECIFICATIONS

185 pp

JULY 1984

MICROMEDIA

GA Technologies

integ
Intercontinental Engineering Ltd

integ
Intercontinental Engineering Ltd.

14 September 1984
File: 0243-K1

Mr. D. Desai
Combustion & Carbonization
Research Laboratory
CANMET, Energy Research Labs.
Dept. of Energy, Mines & Resources
555 Booth St.
Ottawa, Ontario
K1A 0G1

Dear Sir:

Re: Final Report
ARFBC Research Facility Design
Contract Serial No. OSQ82-00224
DSS File No. 15SQ.23440-2-9141

We are pleased to submit herewith five (5) copies of our final report for the above contract. The report was prepared by INTEG-Intercontinental Engineering Ltd. and GA Technologies in accordance with the scope of work set out in Contract OSQ82-00224 and Amendments dated August 15, 1983 and March 1, 1984.

A draft report was presented in August, 1984 and most of the material has also been issued as milestone reports.

The report comprises four volumes, identified as follows:

Volume I - Design Report
Volume II - Equipment Specifications
Volume III - Bidders lists and Equipment Suppliers Quotations
Volume IV - Drawings

All drawings produced for this contract are included in Volume IV in reduced form for convenient reference, and the major drawings are included as well in Appendix II of Volume I for added convenience.

The design report includes a section which details the further work required to complete the procurement and final engineering of the facility. A recommended staged purchasing program is described which will facilitate the final engineering and minimize procurement delays.

0243-0043

.../2

This report describes the second phase of the design of the ARFBC research facility. The first phase, prepared by others, was a conceptual design study. This phase encompasses the first part of the detailed engineering and includes development of the design to the tender stage and preparation of a detailed cost estimate. The information and drawings contained in this report are all subject to revision following procurement and receipt of certified equipment drawings and specifications.

We trust you will find the contents of the report to your satisfaction and will be pleased to offer any further assistance on this project.

Yours very truly,

INTEG-Intercontinental Engineering Ltd.

G.R. Cooper, P.Eng.
Project Manager

GRC/mt
c.c. E. Fresque D.S.S.

DESIGN REPORT

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DESIGN REPORT

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0243-0034

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APPENDIX V

EQUIPMENT SPECIFICATIONS

LIST OF SPECIFICATIONS

111-1	Atmospheric Recirculating Fluidized Bed Combustor
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241-1	Fuel Transfer Screw No. 1

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111-1

ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 111-1
ACCOUNT NO. 0243-111

SPECIFICATION FOR COMBUSTOR

1.0 REQUIREMENT

A tender is requested for the supply of one pilot scale atmospheric recirculating fluidized bed combustor (ARFBC).

2.0 SCOPE OF WORK

The Work includes the fabrication and delivery of one ARFBC as specified herein and in accordance with the following Drawings:

3100001
3100002, sheets 1 and 2
3100003
3100004
3100006

The equipment shall include, but not be limited to the following:

- combustor, comprising a refractory lined steel shell in flanged segments, including:
  - structural support mountings
  - distributor plate with a bolted primary air windbox and distributor nozzles
  - clamping and sealing mechanism at the combustor top for four bayonet tubes
  - penetrations through the shell and refractory with external projections
- primary cyclone with refractory lining, including:
  - vortex finder
  - structural support mountings
  - penetrations through shell and refractory with external projections
- recirculation piping, comprising refractory lined steel piping in flanged segments including:
  - expansion joint
  - penetrations through shell and refractory with external projections

3.0 OPERATING AND DESIGN CONDITIONS

3.1 Specifications

Combustor size	406 mm ID x 6706 mm
Thermal input	724 kW
Maximum bed temperature	1100°C
Maximum shell temperature	93°C
Maximum bed pressure	69 kPa(g)
Operating range:	
- excess air	0 - 70%
- turndown (max. operating)	5:1
- fluidizing velocity range	1.4 - 7.0 m/s 9.3 m/s
- bed heat recovery	0 - 65%

3.2 Performance

The ARFBC shall perform according to the Material and Energy Balances for maximum and minimum design basis fuels, corresponding to the scope of Contractor supply. These balances are included in Schedule I.

The properties of the maximum and minimum calorific value design basis fuels are included in Schedule II.

4.0 TECHNICAL REQUIREMENTS

4.1 The ARFBC, comprising the combustor, cyclone and recirculation loop, shall consist of a refractory lined steel shell with a smooth faced abrasion resistant internal refractory liner.

4.2 A combustor cooling system (specified in Inquiry No. 151-1) will be employed to recover a variable quantity of bed heat, ranging from 0 - 65%.

4.3 The combustor shell shall be gas tight at the maximum conditions of 1,100°C and 69 kPa(g).

4.4 The refractory liner shall be thermally stable at the maximum bed temperature of 1,100°C, and shall maintain the shell temperature below 93°C.

4.5 An explosion relief vent shall be supplied to safely release overpressure caused by deflagrations within the combustor.

4.5 The sealing and clamping system provided at the combustor top for the bayonet heat recovery tubes shall maintain a gas seal at maximum conditions.

4.6 The internal refractory liner shall be carefully shaped around all refractory penetrations to avoid formation of ledges or sharp corners. For the larger material feed penetrations, the liner shall extend the full depth of the penetrations.

4.7 The penetration external projections (flanged nozzles) shall be protected from full bed temperatures to reduce thermal stress and personnel hazard.

4.8 The structural support mountings shall be located so as to eliminate damage due to differential expansion between the components. Adequate expansion devices shall be provided to absorb thermal expansion.

4.9 The cyclone shall pass a maximum dust concentration of 0.074 g/Am^3 (40 $gr/A\ ft^3$) throughout the normal operating range when operating on design basis fuels with flyash recycle.

4.10 The ARFBC exterior surfaces shall be shop treated as follows:

1) All exterior surfaces shall be thoroughly cleaned of all rust, scale, dirt, grease, oil and other foreign matter in accordance with the latest revision of SSPC-SP6-63, Commercial Sandblast Cleaning.

2) One coat of inorganic zinc primer shall be applied to a thickness of 0.08 mm (3 mils).

3) One coat of hi-build epoxy finish coat shall be applied to a thickness of 0.13 mm (5 mils) color to be selected by the Owner after award of Contract.

4.11 The Contractor shall furnish sufficient spare primer and epoxy finish coat to complete painting and touch up in the field.

4.12 The Contractor shall also furnish spare refractory liner material for field touch up.

5.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM

American National Standards Institute	ANSI
American Welding Society	AWS
Steel Structures Painting Council	SSPC

Use of any other standards other than those listed above shall be clearly stated in the bid.

6.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

7.0 DRAWINGS

The Contractor shall provide arrangement and detail drawings and full specifications and instructions for all equipment supplied.

Prior to shipment, the Contractor shall submit one (1) certified reproducible and three (3) certified copies of all required drawings. Drawings shall include shop fabrication drawings and specifications, and a complete bill of materials.

A refractory specification as well as refractory repair procedure shall also be provided.

8.0 PRICING

Schedule III shall be completed and included with the tender.

SCHEDULE I - MATERIAL AND ENERGY BALANCES

COMBUSTOR

The Material and Energy Balances for Maximum and Minimum Design Basis Fuels are provided on pages 3 and 4 of this schedule.

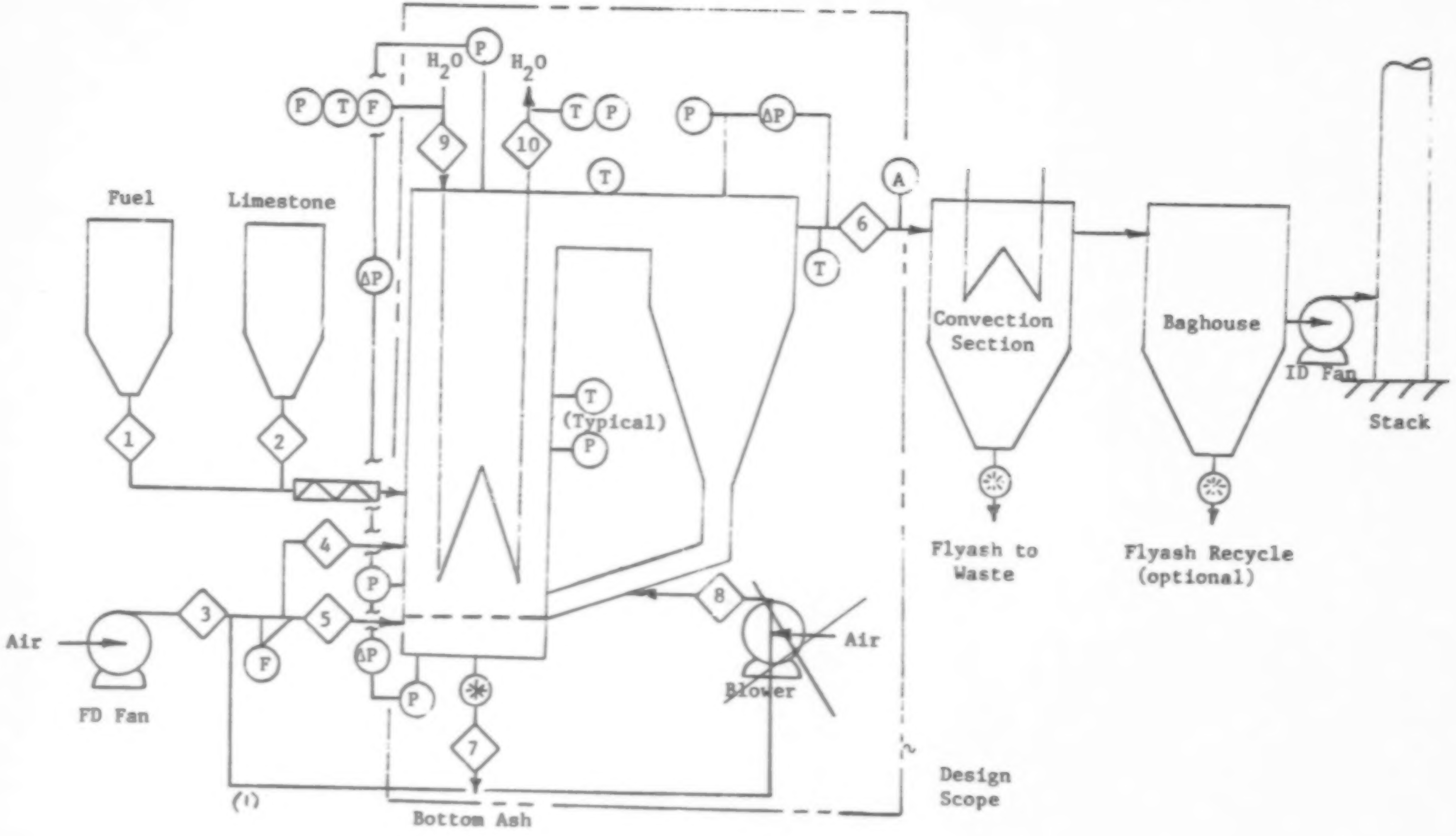
The design basis fuel specifications are provided in Schedule II.

The M & E Balances are those prepared by GA Technologies and issued March 25, 1983. They have, however, been revised to reflect design changes subsequently effected by mutual agreement. These changes are:

1) Forced draft air flows have been corrected to reflect the incorporation of the loop seal and forced draft blowers as one.

2) Water flows have been corrected to reflect revised temperatures and heat recovery performance.

(The changes are noted by the above numbers on the following pages.)


Fuel
Limestone
1
2
3
4
5
6
7
8
9
10
Air
FD Fan
F
P
T
ΔP
A
H$_2$O
H$_2$O
(Typical)
Bottom Ash
(1)
Blower
Air
Design Scope
Convection Section
Flyash to Waste
Baghouse
Flyash Recycle (optional)
ID Fan
Stack

Process Flow Diagram

F = Flow

T = Temperature

P = Pressure

A = Analysis

◇XX = Stream Numbers correspond to Material & Energy Balances

MATERIAL AND ENERGY BALANCES - TARSANDS FLUID COKE (MAXIMUM CV FUEL)

Stream No.	1	2	3 (1)	4	5	6	7	8	9 (2)	10 (2)
Stream	Fuel Fired	Limestone	Forced Air	Secondary Air	Primary Air	Flue Gas & Dust	Bottom Ash	Loop Seal ~~Blower~~ Air	Water	Water
Flow [1]										
kg/s	0.023	0.012	0.280 ~~0.266~~	0.140	0.126	0.311	0.005	0.014	3.109 ~~1.73~~	3.109 ~~1.73~~
lb/hr	184	94	~~2110~~ 2222	1111	999	2461	[5] 39	112	~~13,763~~ 24,681	~~13,763~~ 24,681
Temperature										
°C	21	21	21	21	21	858	871	21	~~10~~ 29	66
°F	70	70	70	70	70	1577	1600	70	~~50~~ 85	150
Pressure										
kPa (abs)	101.4	101.4	114.3	109.9	114.3	101.0	101.4	153.2	273.7 ~~446.3~~	273.7 ~~446.3~~
inches of water	0	0	52	34	52	-1.5	0	208	~~50~~ psig 25	~~50~~ psig 25
Density [2]										
kg/m3	800	1600	1.36	1.31	1.36	0.326	1360	1.82	995 ~~1,000~~	979 ~~981~~
lb/ft3	50	[3] 100	[3] 0.0846	0.0811	0.0846	0.0202	85	[3] 0.1134	~~62.4~~ 62.17	~~61.2~~ 61.19
Volumetric Flow [2]										
m3/s	N/A	N/A	0.206 ~~0.196~~	0.108	0.093	0.936	N/A	0.008		
ft3/min.	N/A	N/A	~~416~~ 438	228	197	1982	N/A	16.5		
U.S. gal/min.	N/A	N/A							49.5 ~~27.5~~	50.3 ~~28.0~~
Heat Content (0°C as reference)										
kW	724	(1)	6.16 ~~5.84~~	2.9	2.6	304	3	0.3	382 ~~73~~	853 ~~475~~
10^6 Btu/hr	2.47	(0.005)	~~0.020~~ 0.021	0.010	0.009	1.038	[5] 0.016	0.001	~~0.25~~ 1.305	~~1.62~~ 2.912

[1] At 7.0 m/s (23 ft/s) superficial gas velocity in combustor.

[2] At actual temperature and pressure.

[3] Approximate or typical values.

[4] Radiation heat losses (cyclone + combustor + Ducting) = 59,000 Btu/hr

[5] Stream 6 contains 59 lb/hr. of flue dust equivalent to 0.024 x 10^6 Btu/hr in heat content

MATERIAL AND ENERGY BALANCES - COAL WASHERY REJECTS (MINIMUM CV FUEL)

Stream No.	1	2	3 (1)	4	5	6	7	8	9 (2)	10 (2)
Stream	Fuel Fired	Limestone	Forced Air	Secondary Air	Primary Air	Flue Gas & Dust	Bottom Ash	Loop Seal ~~Blower~~ ~~Ash~~ Air	Water	Water
Flow [1]										
kg/s	0.083		0.248 ~~0.221~~	0.116	0.105	0.289	0.027	0.012	1.501 ~~0.980~~	1.501 ~~0.980~~
lb/hr	659	0	~~1750~~ 1842	921	829	2286 [5]	215	92	~~7760~~ 11,915	~~7760~~ 11,915
Temperature										
°C	21		21	21	21	860	871	21	~~10~~ 29	66
°F	70		70	70	70	1580	1600	70	~~50~~ 85	150
Pressure										
kPa (abs)	101.4		114.3	109.9	114.3	101.0	101.4	153.2	273.7 ~~446.3~~	273.7 ~~446.3~~
inches of water	0		52	34	52	-1.5	0	208	~~50~~ psig 25	~~50~~ psig 25
Density [2]										
kg/m3			1.36	1.31	1.36	0.305	1360	1.82	995 ~~1,000~~	979 ~~981~~
lb/ft3			0.0846	0.0811	0.0846	0.0189	85 [3]	0.1134	~~62.4~~ 62.17	~~61.2~~ 61.19
Volumetric Flow [2]										
m^3/s	N/A		0.182 ~~0.16~~	0.09	0.08	0.893	N/A	0.006		
ft3/min	N/A		~~345~~ 363	189	163	1892	N/A	13.5		
U.S. gal./min.	N/A						N/A		23.8 ~~13.5~~	24.3 ~~13.8~~
Heat Content (0°C as reference)										
kW	569		5.3 ~~5.0~~	2.6	2.4	300	25.3	0.3	185 ~~41.1~~	412 ~~269~~
10^6 Btu/hr	1.94	0	~~0.017~~ 0.018	0.009	0.008	1.023 [5]	0.088	0.001	~~0.14~~ 0.630	~~0.916~~ 1.406

[1] At 7.0 m/s (23 ft/s) superficial gas velocity in combustor.

[2] At actual temperature and pressure.

[3] Approximate or typical values.

[4] Radiation heat losses (cyclone + combustor + Ducting) = 59,000 Btu/hr.

[5] Stream 6 contains 141 lb/hr of flue dust equivalent to 0.057 x 10^6 Btu/hr in heat content

SCHEDULE II - DESIGN BASIS FUEL PROPERTIES

COMBUSTOR

		MINIMUM	MAXIMUM
PROXIMATE ANALYSIS	(As Received)		
Moisture	%	20.1	3.6
Volatile matter	%	N/A	7.0
Fixed carbon	%	N/A	83.0
Ash	%	53.5	6.4
Higher heating value	kJ/kg	6,849	31,263
ULTIMATE ANALYSIS			
Sulphur	%	0.10	6.80
Hydrogen	%	3.76	1.20
Carbon	%	17.76	79.50
Nitrogen	%	0.38	1.20
Oxygen	%	24.50	2.50
Vanadium	ppm	-	1,700
Unaccounted	%	-	2.40
Ash	%	53.50	6.40
Ash fusion temp.	°C	1,280	1,370
SIZE DISTRIBUTION	(By Weight)		
50 mm - 38 mm		-	-
38 mm - 25 mm		-	-
25 mm - 19 mm		-	-
19 mm - 13 mm		3.04	-
13 mm - 6 mm		20.20	-
6 mm - 3 mm		28.34	-
3 mm - 16 mesh		16.90	-
16 mesh - 100 mesh		9.52	-
28 mesh - 100 mesh		22.00	-
100 mesh - 0		-	100

NOTE: Minimum and maximum denote minimum and maximum calorific value design basis fuels. Properties for minimum CV fuel is taken from Stercoe No. 3 Heavy Medium Cyclone Reject Coal and maximum CV fuel from Syncrude Fluid Coke.

SCHEDULE III - SCHEDULE OF PRICES

COMBUSTOR

1. Combustor as described in the specification, FOB point of sale $ __________

2. Canadian Customs Duty _____ % of $ __________ $ __________

3. Transportation to site $ __________

TOTAL $ __________

121-1

FORCED DRAFT BLOWER

PROJECT 0243	DATE:
ENERGY, MINES AND RESOURCES CANADA	INQUIRY NO. 121-1
ARFBC RESEARCH FACILITY	ACCOUNT NO. 0243-121

SPECIFICATION FOR FORCED DRAFT BLOWER

1.0 REQUIREMENT

Tenders are invited for the supply of one forced draft combustion air blower.

2.0 SCOPE OF WORK

The work includes the supply, shop testing and delivery of one air blower as specified herein, which shall include but not be limited to the following:

- blower complete with drive and motor on an integral base
- drive guard
- inlet filter with weather hood (supplied loose)
- inlet silencer
- non return valve
- pressure relief valve
- discharge silencer
- flexible inlet and discharge connections
- flexible support mountings and anchor bolts
- acoustic hood for noise abatement to 85 dBA (at 1 meter).
- startup assistance
- (optional) - manually controlled variable speed drive.
- any special tools required for installation and/or maintenance.

3.0 OPERATING AND DESIGN CONDITIONS

Inlet temperature	21°C
Inlet air density	1.184 kg/sm^3
Required discharge capacity	0.378 sm^3/s (800 ACFM)
Required discharge pressure	83 kPa(g) (12 psig)

4.0 DESIGN DATA

Site elevation (Ottawa) is 103 m ASL
Suction air is to be drawn from outside the building enclosure.
Ambient design temperatures are - summer: 30°C
winter: -25°C

5.0 TECHNICAL REQUIREMENTS

5.1 Accoustical protection shall be provided to maintain maximum noise level of 85 dBA at 1 m.

5.2 Electrical power will be supplied at 575 V, 3-phase and 115/230 V 1-phase. The drive motor shall be totally enclosed. Its temperature rise shall not be greater than for Class B insulation. It shall be equipped with a removable drain plug.

5.3 The pipe flanges shall be ANSI 150 lb standard.

5.4 The blower and accessories shall be supplied totally assembled, including all lubrication and local cooling piping, with the exception of the inlet filter and the weather hood and the discharge silencer, all of which shall be supplied loose.

5.5 The F.D. blower shall be capable of operating in an unheated enclosure located out of doors if so required. The additional cost of this requirement, if applicable, shall be stated as an optional extra.

6.0 ALTERNATIVES AND EXTRAS

The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

Specifically, the bidder is requested to price as an optional extra a variable speed drive for the F.D. blower. The optional drive is specified in Section 7.0.

7.0 VARIABLE SPEED DRIVES (OPTIONAL ALTERNATIVE)

7.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

7.2 The motor shall be totally enclosed. Its temperature rise shall not be greater than for Class B insulation. It shall be equipped with a removable drain plug.

7.3 Motors with permanent magnet fields shall be supplied where feasible.

7.4 The drive controller shall be contained in an EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

7.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

7.6 The following accessories shall be provided:

a) Pickup for speed indicator
b) Auxiliary contacts for interlock

7.7 The following operators controls shall be provided:

a) Speed adjusting potentiometer
b) Start-stop switch
c) Speed indicator, 2% accuracy

8.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Testing Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

9.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the contract documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

The bidder shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied and a blower performance curve. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be furnished with the tender.

Prior to shipment, the successful bidder shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, control schematic, wiring diagrams, performance curves, and specification sheets. All of these drawings and specifications shall be certified.

The successful bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

FORCED DRAFT BLOWER

1.	Forced draft blower as described in the specification, FOB point of sale	$ ______
2.	Canadian Customs Duty _____ % of $ __________	$ ______
3.	Transportation to site	$ ______
	TOTAL	$ ______

SCHEDULE II - TECHNICAL DATA

FORCED DRAFT BLOWER

1.0 SPECIFICATIONS

Manufacturer's name ______________________________

Vendors name ______________________________

Model and type ______________________________

Volume ______________ m^3/s

Discharge pressure ______________ kPa(g)

Discharge temperature ______________ °C

Blower RPM ______________

Diameter of suction ______________ mm

Diameter of discharge ______________ mm

Maximum power consumption ______________ kW

Minimum flow ______________ m^3/s

Maximum noise level ______________ dBA

Cooling method ______________

Cooling water requirements ______________ m^3/s

Drive type and specification ______________

Inlet filter type and size ______________

Motor

- Manufacturer ______________________________
- Power ouput ______________ kW
- Speed ______________ rpm
- Enclosure type ______________________________

- **Temperature rise** __________ °C
- **Frame size** __________

Optional variable speed drive

- **Type** ____________________
- **Manufacturer** ____________________
- **Model** ____________________
- **Speed ratio** __________
- **Power supply requirements** ______ kVA ______ V ____ phase

Variable speed drive motor

- **Manufacturer** ____________________
- **Power ouput** __________ kW
- **Speed** __________ rpm
- **Enclosure type** ____________________
- **Temperature rise** __________ °C
- **Frame size** __________

Total weight __________ kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

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3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

131-1
IGNITION BURNER

131-1

PROJECT 0243	DATE:
ENERGY, MINES AND RESOURCES CANADA	INQUIRY NO. 131-1
ARFBC RESEARCH FACILITY	ACCOUNT NO. 0243-131

SPECIFICATION FOR IGNITION BURNER

1.0 REQUIREMENT

Tenders are invited for the supply of one propane fired ignition burner.

2.0 SCOPE OF WORK

The work shall include the supply, shop assembly, shop testing, and delivery of one ignition burner as specified herein, which shall include but not be limited to the following:

- burner complete with burner block and mounting flange
- pilot with spark plug ignitor and ignition transformer
- UV flame scanner
- prepiped and wired air and gas valve train
- prewired local control panel
- burner mounting gasket
- complete valve train assembly on a structural frame
- spare burner orifice for natural gas fuel
- startup assistance

3.0 OPERATING AND DESIGN DATA

Thermal output	470 kW
Fuel	Propane
Fuel pressure	103 kPag
Combustion air pressure	70 kPag
Combustion chamber backpressure	
- Normal	14 kPag
- Maximum	35 kPag
Site elevation ASL	100 m

4.0 DESIGN CONDITIONS

4.1 The burner will be required for ignition and occasional combustion stabilization of a fluidized bed combustor research facility. It will cross fire into the combustor as shown on sketch 0243 SK 131-1, included with this specification.

4.2 Combustor backpressure may vary over the range of operating conditions, however the burner will operate at a manually adjustable firing rate.

4.3 Two operating modes shall be employed:

1) Normal ignition service

The burner will be manually initiated to preheat a bed of mildly fluidized sand against relatively low backpressure (14 kPag). The burner will be manually shut off when the bed reaches normal ignition temperature (30-60 minutes).

2) Combustion stabilization service

The burner will be manually initiated during operation of the combustor against relatively high and variable backpressure (21-35 kPag). Operation in this mode should not exceed 30 minutes.

4.4 Combustion air will be provided in sufficient volume at a maximum pressure of 70 kPag.

4.5 Electrical power will be provided at 575 V 3-phase and 115/230 V 1-phase.

5.0 TECHNICAL REQUIREMENTS

5.1 The burner shall be equipped with a dust tight prewired local control panel. Provision shall be made for the following alarm functions on the Owner's remote control panel

- Flame Failure Alarm
- Burner Trip Alarm

5.2 The burner, piping, and controls shall be designed in accordance with NFPA 85A "Single Burner Boiler - Furnaces", 1982.

5.3 Combustion control shall be largely manual. The following functions shall be included:

- Burner output shall be manually adjustable from 10 to 100% of rating. This shall be accomplished by adjustment of only one control device.
- The control system shall maintain air fuel mixture at a pre-established ratio throughout the operating range of the burner and during changes in firing rate.
- The control system shall also maintain the required air and fuel pressures throughout the operating range of the burner. Furnace pressure sensing signal will be provided.
- A manually initiated purge cycle shall be provided.
- Fuel interlocks shall prevent manually initiated ignition prior to completion of the purge cycle. Interlocks shall include provision for a burner trip input from contacts supplied by others.

5.4 The burner should have a short flame such that it does not impinge on the adjacent refractory wall surface.

5.5 The flame scanner should be located such that it will not be blinded by slugs of sand or fuel that can be expected to enter the burner penetration.

5.6 A small round burner block is preferable.

6.0 ALTERNATIVES AND EXTRAS

The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

7.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

Canadian Standards Association	CSA
Canadian Gas Association	CGA
National Fire Protection Association	NFPA
Underwriters Laboratories	UL

8.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

9.0 DRAWINGS AND MANUALS

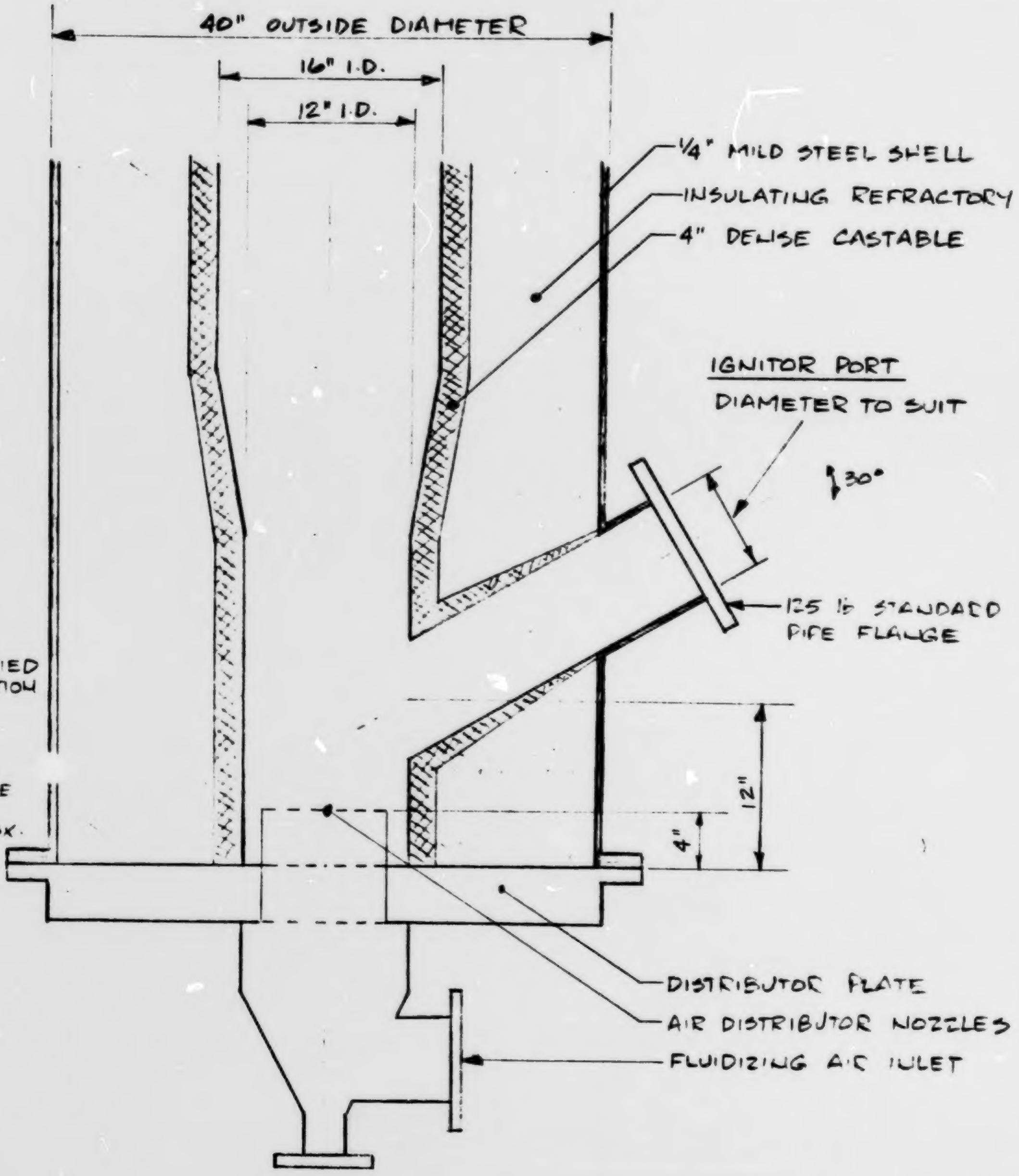
The Bidder shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. The Bidder shall also include a control schematic, and diagrams of the interlock logic and operating sequence(s), as well as a wiring diagram.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, control schematic, wiring diagrams, and specification sheets. All of these drawings and specifications shall be certified.

The successful tenderer shall also supply six (6) copies of maintenance and operating manuals.

10.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.


40" OUTSIDE DIAMETER
16" I.D.
12" I.D.
1/4" MILD STEEL SHELL
INSULATING REFRACTORY
4" DENSE CASTABLE
IGNITOR PORT
DIAMETER TO SUIT
30°
125 lb STANDARD PIPE FLANGE
NOTE: THIS AREA SIMPLIFIED FOR ILLUSTRATION
NOT SHOWN
- 4" DIA. FUEL FEED CHUTE.
- 6" DIA RECYCLE CHUTE.
(BOTH AT APPROX. SAME LEVEL AS IGNITOR PORT.)
12"
4"
DISTRIBUTOR PLATE
AIR DISTRIBUTOR NOZZLES
FLUIDIZING AIR INLET

SECTION AT BOTTOM OF COMBUSTOR

TOTAL HEIGHT = 22'

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd.

SCALE		**DATE**	
DRAWN		AUG. 8/83	IGNITOR PORT DETAIL
CHECK			
APP'D.			

A	0243	SK	131-1	0

SCHEDULE I - SCHEDULE OF PRICES

IGNITION BURNER

1. Ignition burner as described in the specification, FOB point of sale $ __________

2. Canadian Customs Duty
_____ % of $ __________ $ __________

3. Transportation to site $ __________

TOTAL $ __________

SCHEDULE II - TECHNICAL DATA

IGNITION BURNER

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Model and Type ______________________________

Flame length ____________ mm

Combustion air pressure required

- Normal ____________ kPag
- Maximum ____________ kPag

Mounting flange size ____________ mm

Weight of burner ____________ kg

Weight of valve assembly ____________ kg

Weight of control panel ____________ kg

Dimensions of control panel ____________ mm

Control power requirements ______ VA _____ V ____ phases

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

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____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

141-1

BED DRAIN COOLER

141-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 141-1
ACCOUNT NO. 0243-141

SPECIFICATION FOR BED DRAIN COOLER

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) bed drain cooler (ash cooler).

2.0 SCOPE OF WORK

The Vendor shall supply, shop test and deliver one (1) ash cooler as specified herein which shall include but not be limited to the following:

- a water-cooled, hollow-flight, hollow-shaft, screw feeder complete with couplings, bearings, etc.
- water jacketed feeder trough complete with cover, gaskets, flanged inlet, flanged outlet, and coolant piping connections.
- a rotary joint to allow screw rotation and provide a seal to stationary piping
- variable speed drive including motor, base, reducer and guards
- any special tools required for installation and/or maintenance
- standard shop coat of primer and paint.

3.0 OPERATING AND DESIGN DATA

Type of Material	Spent limestone sorbent plus combustor bottom ash
Bulk Density	1360 kg/m^3 (85 lb/ft^3)
Material Size	-6mm (-1/4 in.) with possible lumps to 50 mm (2 in.)
Material Inlet Temperature	1100°C (2012 °F)
Desired Final Temperature	150°C (302°F)
Normal Feed Rate Range	0 to 0.027 kg/s (0 to 214 lb/h)
Design Feed Rate	0.041 kg/s (325 lb/h)
Operating Duty	2,000 hours annually
Coolant	Water

Cooling Water Temperatures

- inlet	29°C
- outlet	66°C

Connection sizes:

- ash inlet	75 mm dia.
- ash outlet	Bidder to specify
- water inlet and outlet	Bidder to specify

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- feeder inlet flange
- coolant pipe connections including rotary joints
- feeder outlet flange
- electrical terminal box on drive.

5.0 TECHNICAL REQUIREMENTS

5.1 The cooler is to be installed at a 15 degree inclination vertically upwards from inlet to outlet.

5.2 A manually controlled variable speed drive is to be furnished.

6.0 VARIABLE SPEED DRIVES

6.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

6.2 The motor shall be totally enclosed. Its temperature rise shall not be greater than for Class B insulation. It shall be equipped with a removable drain plug.

6.3 Motors with permanent magnet fields shall be supplied where feasible.

6.4 The drive controller shall be contained in an EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

6.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

6.6 The following accessories shall be provided:

a) Pickup for speed indicator

6.7 The following operators controls shall be provided:

a) Speed adjusting potentiometer
b) Start-stop switch
c) Speed indicator, 2% accuracy

6.8 Electrical power will be supplied at 115 V or 230 V 1-phase.

7.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
Conveyor Equipment Manufacturers Association	CEMA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, piping and support connections should be clearly indicated. A control schematic and a wiring diagram shall also be submitted with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

BED DRAIN COOLER

1.	One (1) ash cooler as described in the specification, FOB point of sale	$ __________
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ __________
	TOTAL	$ __________

SCHEDULE II - TECHNICAL DATA

BED DRAIN COOLER

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Model and Type ______________________________

Ash cooler overall dimensions ____________ mm

Unit total weight ____________ kg

Screw diameter ____________ mm

Flight material ____________

Flight thickness ____________ mm

Screw pitch ____________ mm

Screw shaft diamter ____________ mm

Screw bearings (type) ____________

Trough material ____________

Trough material thickness ____________ mm

Trough jacket thickness ____________ mm

Connection sizes

- inlet ____________ mm
- outlet ____________ mm
- water inlet ____________ mm
- water outlet ____________ mm

Variable speed drive

- Type ____________
- Manufacturer ____________

- Model No. ________________
- Speed ratio ________________
- Power rating ________________ kW
- Supply voltage ________ V ________ phase

Motor data

- Enclosure type ________________
- Manufacturer ________________
- Power output ________________ kW
- Speed ________________ rpm
- Temperature rise ________________ °C
- Frame size ________________

Unit output max. ________________ kg/s

Unit output min. ________________ kg/s

Water usage @ design conditions ________________ kg/s

Max. water usage ________________ kg/s

Max. continuous operating temp. ________________ °C

2.0 LIST OF ALTERNATIVES AND EXTRAS

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____

____

____

____

3.0 DELIVERY

Time required for manufacture
and shipment from receipt of order ________________ months

151-1

COMBUSTOR BAYONET TUBES

151-1

PROJECT 0243	DATE:
ENERGY, MINES AND RESOURCES CANADA	INQUIRY NO. 151-1
ARFBC RESEARCH FACILITY	ACCOUNT NO. 0243-151

SPECIFICATION OF BAYONET TUBE HEAT EXCHANGER

1.0 REQUIREMENT

A tender is requested for the supply of six (6) bayonet tube heat exchangers.

2.0 SCOPE OF WORK

The Work includes the fabrication, shop testing, and delivery of six (6) bayonet tube heat exchangers as specified herein, which shall include, but not be limited to the following:

- bayonet tubes according to GA Technologies drawing 3100005
- shop hydrostatic testing

3.0 OPERATING AND DESIGN DATA

Heat duty	469 kW
Coolant	Water
Coolant flow	217 l/s
Coolant temperature:	
- inlet	29°C
- outlet	66°C
Pressure:	
- operating	621 kPa(g)
- design	1034 kPa(g)
- test	930 kPa(g)
Maximum pressure drop	220 kPa

4.0 TECHNICAL REQUIREMENTS

4.1 All welds shall be tested. The end cap weld shall be x-rayed and all others shall be checked with dye penetrant or magnaflux.

4.2 The end cap shall be aligned carefully with the outside of the tube, and the cap weld shall be ground flush. Any misalignment after welding shall be carefully ground out.

4.3 All tubes and pipes shall be straight and true before and after fabrication. Exchangers shall be carefully packed for shipment to ensure that no damage occurs during transport.

4.3 Water hose connections shall be provided which are capable of withstanding full design pressure.

4.4 Each exchanger shall be hydrostatically shop tested at 930 kPa(g) prior to delivery.

4.5 Water hose connections shall be capable of withstanding the mechanical loads of the water hoses.

4.6 Lifting lugs which will support the full static and dynamic load of the individual exchangers shall be provided to permit tube retraction from the combustor.

5.0 CODES AND STANDARDS

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
Heat Exchange Institute	HEI
Tubular Exchanger Manufacturers' Association	TEMA

6.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

7.0 DRAWINGS

The Contractor shall provide detailed arrangement drawings and a complete bill of materials with full specifications. One (1) reproducible and three (3) copies shall be provided for all required drawings. All of the drawings and specifications shall be certified.

8.0 PRICING

Schedule 1 shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

BAYONET TUBE HEAT EXCHANGER

1.	Bayonet tube heat exchanger as described in the specification, FOB point of sale	$ __________
2.	Canadian Customs Duty _____ % of $ __________	$ __________
3.	Transportation to site	$ __________
	TOTAL	$ __________

152-1

FLUE GAS COOLER

152-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 152-1
ACCOUNT NO. 0243-152

SPECIFICATION FOR FLUE GAS COOLER

1.0 REQUIREMENT

Tenders are invited for the supply of one flue gas to water heat exchanger.

2.0 SCOPE OF WORK

The work includes the supply, shop testing and delivery of one shell and tube heat exchanger as specified herein, which shall include but not be limited to the following:

- shell
- tubes with tubesheet
- baffles and tube supports
- fluegas, ash and water nozzle connections
- gaskets
- structural support lugs
- special tools for erection and maintenance.

3.0 OPERATING AND DESIGN CONDITIONS

		Shell Side	Tube Side
Fluid circulated		Flue Gas	Water
Maximum flow rate	(kg/s)	0.304	Bidder to Specify
Design flow rate	(kg/s)	0.474	Bidder to Specify
Temperature in	(°C)	860	29
Temperature out	(°C)	150	66
Design temperature	(°C)	1,100	-
Operating pressure	(kPag)	- 2	470
Density	(kg/Am^3)	0.326	996
Specific heat	(kJ/kg °C)	1.143	4.187
Entrained particulate	(kg/s)	0.03	-
Cleanliness factor	(%)		80
Inlet connection size	(mm)	300	Bidder to Specify
Outlet connection size	(mm)	200	Bidder to Specify

Exchanger type	U-tube (or as alternatively specified by bidder)
Exchanger orientation	Vertical
Material requirements	Bidder to specify

4.0 DESIGN DATA

4.1 The cooler shall cool hot flue gas from a pilot scale fluidized bed combustor, which will process a variety of fuels including coal, coke, wood and peat.

4.2 Cooling water shall be pumped from a municipal supply, and maintained at temperature by a closed circuit cooling tower.

5.0 TECHNICAL REQUIREMENTS

5.1 The cooler shall be installed in a vertical orientation, with horizontal inlet and outlet flue gas (shell) connections and all water connections at the top.

5.2 The tube bundle shall be removable to permit cleaning.

5.3 Baffles shall be sloped in the direction of gas flow so as not to trap any particulate that may be collected in the cooler.

5.4 The shell cover at the bottom of the cooler shall comprise a concentric reducer with a 100 mm flanged outlet for removal of collected particulate.

5.5 The cooler shall provide if possible for isolation of approximately 30 to 50 percent of the cooling surface for operating flexibility.

5.6 All flanges shall be standard ANSI, rated 150 psig.

6.0 ALTERNATIVES AND EXTRAS

6.1 At the bidder's discretion, plate or rectangular tubesheet exchangers, suitably encased to conform to item 5.1, may be proposed.

6.2 The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

7.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Petroleum Institute	API
American Society of Mechanical Engineers	ASME
American Society of Testing Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
Heat Exchange Institute	HEI
Tubular Exchanger Manufacturers Association	TEMA

8.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

9.0 DRAWINGS AND MANUALS

The bidder shall submit with his tender an arrangement drawing of the equipment. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All piping and support connections should be clearly indicated.

Prior to shipment, the successful bidder shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, performance curves, and specification sheets. All of these drawings and specifications shall be certified.

10.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

FLUE GAS COOLER

1.	Flue gas cooler as described in the specification, FOB point of sale	$ __________
2.	Canadian Customs Duty _____ % of $ __________	$ __________
3.	Transportation to site	$ __________
	TOTAL	$ __________

SCHEDULE II - TECHNICAL DATA

FLUE GAS COOLER

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Model and Type ______________________________

Exchanger Type ______________________________

Duty ______________ kW

Water flow - maximum ______________ kg/s

Water flow - design ______________ kg/s

Tube side pressure drop:

- Operating condition ______________ kPa
- Design condition ______________ kPa

Shell side pressure drop:

- Operating condition ______________ kPa
- Design condition ______________ kPa

Design pressure:

- Tube side ______________ kPa
- Shell side ______________ kPa

Test pressure:

- Tube side ______________ kPa
- Shell side ______________ kPa

Gasket type:

- Flue gas nozzles ______________
- Water nozzles (if applicable) ______________

Shell outside diameter __________ **mm**

Tube diameter and wall thickness __________ **mm**

Number of tube passes __________

Water connection sizes

- **inlet** __________ **mm**
- **outlet** __________ **mm**

Tube withdrawal space __________ **mm**

Overall exchanger length __________ **m**

c-c dimension - flue gas nozzles __________ **m**

Material

- **Tubes** __________
- **Shell** __________
- **Baffles** __________
- **Nozzle flanges** __________

Weight:

- **dry** __________ **kg**
- **flooded** __________ **kg**

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order. __________ **months**

153-1

WATER COOLING SYSTEM

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 153-1
ACCOUNT NO. 0243-153

SPECIFICATION FOR WATER COOLING SYSTEM

1.0 REQUIREMENT

Tenders are invited for the supply of one closed circuit water cooling system.

2.0 SCOPE OF WORK

The work includes the supply, shop testing, and delivery of one shell and tube heat exchanger and one forced air cooling tower, which shall include but not be limited to the following:

Heat Exchanger

- shell
- tube bundle
- baffles and tube supports
- water boxes
- compression seal
- water nozzle connections
- support mounting

Cooling Tower

- water distribution system
- wet deck surface
- moisture eliminators
- centrifugal fans(s)
- fan motor
- motor drive
- variable air inlet vanes
- water strainer (supplied loose)
- modulating freeze-proof capacity control dampers
- electric damper actuator and controls
- oversize water outlet for remote sump operation
- special tools for installation and maintenance
- corrosion protection
- casing
- weather protection

3.0 OPERATING AND DESIGN DATA

Heat Exchanger		Shell Side	Tube Side
Fluid circulated		Water	Water
Normal flow rate	(kg/s)	5.013	Bidder to Specify
Design flow rate	(kg/s)	6.918	Bidder to Specify
Temperature in	(°C)	66	Bidder to Specify
Temperature out	(°C)	29	Bidder to Specify
Operating pressure	(kPag)	600	Bidder to Specify
Design pressure	(kPag)	Bidder to Specify	Bidder to Specify

Cooling Tower

Fluid circulated		Water
Design flow rate	(kg/s)	Bidder to Specify
Water temperature in	(°C)	Bidder to Specify
Water temperature out	(°C)	Bidder to Specify
Air temperature	(°C WB)	23
Air temperature	(°C DB)	30
Site elevation	(m ASL)	100

The system shall operate for approximately 2,000 hours annually.

4.0 DESIGN CONDITIONS

4.1 The cooling tower and heat exchanger will be located on an elevated platform in an unheated enclosure.

4.2 The balance of the equipment will be located inside a heated building.

4.3 The ambient air will contain flyash and coal dust particulate as well as fumes from various pilot scale coal utilization processes.

5.0 TECHNICAL REQUIREMENTS

5.1 The cooling tower will be designed for operation with an external sump (not included with this tender).

5.2 The cooling tower shall be designed such that the damper and water spray systems shall not freeze up during winter operation. The power supply to the damper motor will be 115 Volt, 1 phase. The damper motor and controls shall be totally enclosed (weatherproof), with internal thermostatically controlled heater.

5.3 The fan drive motor shall be 575 V, 3-phase, totally enclosed. Its temperature rise shall not be greater than for class B insulation. It shall be equipped with a removable drain plug.

5.4 The heat exchanger shall be a compact design suitable for installation on or near a concrete wall.

5.5 A ducting elbow will be provided for the discharge of the cooling tower in order to remove discharge stream from the enclosure (N.I.C.).

6.0 ALTERNATIVES AND EXTRAS

The bidder may offer an alternative arrangement to that specified herein that will satisfy the performance requirements.

The bidder is requested to clearly state and separately price any alternative or separate components he may feel are appropriate either for performance or reliability considerations.

7.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Petroleum Institute	API
American Society of Mechanical Engineers	ASME
American Society of Testing Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
Heat Exchange Institute	HEI
Tubular Exchanger Manufacturers Association	TEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

8.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

9.0 DRAWINGS AND MANUALS

The bidder shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be submitted with the bid.

Prior to shipment, the successful bidder shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, control schematic, wiring diagrams, performance curves, and specification sheets. All of these drawings and specifications shall be certified.

The successful tenderer shall also supply six (6) copies of maintenance and operating manuals.

10.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

WATER COOLING SYSTEM

1.	Heat exchanger as described in the specification, FOB point of sale	$ __________
2.	Cooling tower as described in the specification, FOB point of sale	$ __________
3.	Canadian Customs Duty _____ % of $ __________	$ __________
4.	Transportation to site	$ __________
	TOTAL	$ __________

SCHEDULE II - TECHNICAL DATA

WATER COOLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Model and Type

- Exchanger ______________________________
- Cooling tower ______________________________

Heat Exchanger	Shell Side	Tube Side	
Water flow			
- normal			kg/s
- design			kg/s
Temperature			
- in			oC
- out			oC
Pressure			
- normal			kPag
- design			kPag
- test			kPag
Pressure drop			
- normal			kPag
- design			kPag
Water connection size			mm
Duty			kJ/h
Tube withdrawal space			mm

Shell outside dia. ______________ mm

Tube diameter and thickness ______________ mm

Material

- tubes ______________
- shell ______________

Weight

- dry ______________ kg
- flooded ______________ kg

Cooling Tower

Duty ______________ kJ/h

Makeup water requirement

- normal ______________ kg/s
- design ______________ kg/s

Water pressure drop

- normal ______________ kPag
- design ______________ kPag

Fan capacity ______________ Am^3/s

Fan RPM ______________

Fan power ______________ kW

Motor

- manufacturer ______________
- power output ______________ kW
- speed ______________ rpm
- enclosure type ______________
- temperature rise ______________ °C
- frame size ______________

Damper motor manufacturer, type and size model no. ______________

Damper motor power requirements ______ VA _____ V ____ phase

Water connection sizes

- inlet ______________ mm
- drain ______________ mm

Air connection dimensions

- intake ______________ mm
- discharge ______________ mm

Unit dimensions

- height ______________ m
- length ______________ m
- width ______________ m

Weight

- empty ______________ kg
- flooded ______________ kg

Type of corrosion protection ______________

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture
and shipment from receipt of order ______________ months

153-2

COOLING WATER PUMPS

153-2

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 153-2
ACCOUNT NO. 0243-153

SPECIFICATION FOR COOLING WATER PUMPS

1.0 REQUIREMENT

Tenders are invited for the supply of two (2) pumps for water service, identified as follows:

1) Circulating water pump

2) Cooling tower pump

2.0 SCOPE OF WORK

The work includes the supply, shop testing, and delivery of two pumps as specified herein, which shall include but not be limited to the following:

- pump
- electric motor drive
- coupling and coupling guard
- common baseplate for pump and drive with alignment system
- factory assembly of pump and drive on a common baseplate
- special tools for installation and maintenance

3.0 OPERATING AND DESIGN DATA

3.1 Circulating Water Pump

Fluid	Water	
Design capacity	413 l/m	(110 USgpm)
Total discharge head	63 m	(205 ft)
Operating temperature	29°C	(85°F)
NPSH	10 m	(33 ft)

3.2 Cooling Tower Pump

Fluid	Water	
Design capacity	1,210 l/m	(320 USgpm)

Total discharge head	18 m	(59 ft)
Operating temperature	27°C	(80°F)
NPSH	10 m	(33 ft)

4.0 TECHNICAL REQUIREMENTS

4.1 Both pumps shall have horizontal end suction and vertical discharge.

4.2 Maximum noise level shall be 85 dBA at a distance of 1 m.

4.3 The drive motors shall be 575 V 3-phase and shall be totally enclosed. Its temperature rise shall not be greater than for class B insulation. It shall be equipped with a removable drain plug.

4.4 The pump, motor, and coupling shall be factory assembled on a common baseplate.

5.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers Association of Canada	EEMAC

6.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

7.0 DRAWINGS AND MANUALS

The tenderer shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied and a pump performance curve. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated.

Prior to shipment, the successful tenderer shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, control schematic, wiring diagrams, performance curves, and specification sheets. All of these drawings and specifications shall be certified.

The successful tenderer shall also supply six (6) copies of maintenance and operating manuals.

8.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

COOLING WATER PUMPS

1.	**Pumps as described in the specification, FOB point of sale**	
	a) Circulating water pump	$ ________
	b) Cooling water pump	$ ________
2.	Canadian Customs Duty _____ % of $ _________	$ ________
3.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

COOLING WATER PUMPS

1.0 SPECIFICATIONS

Manufacturer's name ____________________

Vendors name ____________________

	Circulating	Cooling Tower
Volume m^3/s		
Discharge pressure kPa (g)		
Inlet size mm		
Discharge size mm		
Drive type		
Pump RPM		
Motor		
- manufacturer		
- power output	kW	kW
- speed	rpm	rpm
- enclosure type		
- temperature rise	°C	°C
- frame size		
Net weight	kg	kg
Overall dimensions	mm	mm

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

153-3

COOLING TOWER SUMP

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 153-3
ACCOUNT NO. 0243-153

SPECIFICATION FOR COOLING TOWER SUMP

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) sump tank for clean water service.

2.0 SCOPE OF WORK

The Work includes the fabrication, hydrostatic testing, and delivery of one sump tank as specified herein, which shall include but not be limited to the following:

- tank as shown on sketch 0243 SK 153-1 complete with lid and reinforced bottom plate with integral anchor bolt flanges
- the following nozzles shall be provided (the locations are shown on sketch 0243 SK 153-1):

1	-	400 mm	manhole
1	-	150 mm	flanged
1	-	100 mm	flanged
2	-	62.5 mm	half coupling
1	-	50 mm	vent
3	-	50 mm	nipple
2	-	37.5 mm	half coupling
1	-	25 mm	nipple
2	-	19 mm	half coupling

- corrosion protection
- hydrostatic test

3.0 OPERATING AND DESIGN DATA

Fluid	Clean water
Fluid temperature	27°C
Diameter	1830 mm
Height	1780 mm

Design pressure	103.4 kPa(g)
Operating pressure	Atmospheric

Service - the sump will be rigidly mounted on a concrete pad in a heated building. Water level is expected to vary continuously. Water will be collected in the sump and pumped to a cooling tower spray header.

4.0 TECHNICAL REQUIREMENTS

4.1 The bidder shall specify a means of providing corrosion protection, as rust must not be released into the system. This protection may be a protective coating, galvanizing, or fabrication in a corrosion resistant alloy or material.

4.2 All tank nozzles 100 mm and larger shall be flanged (150 psi ANSI flanges). Nipples and half couplings shall be threaded in the appropriate NPT sizes.

4.3 The tank shall be hydrostatically tested in the shop by sealing all nozzles, filling with water and pressurizing to 103.4 kPa(g).

4.4 If the interior of the tank is to be painted, the exterior shall also be painted. Final colour to be selected by Owner after award of Contract.

5.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Petroleum Institute	API

6.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

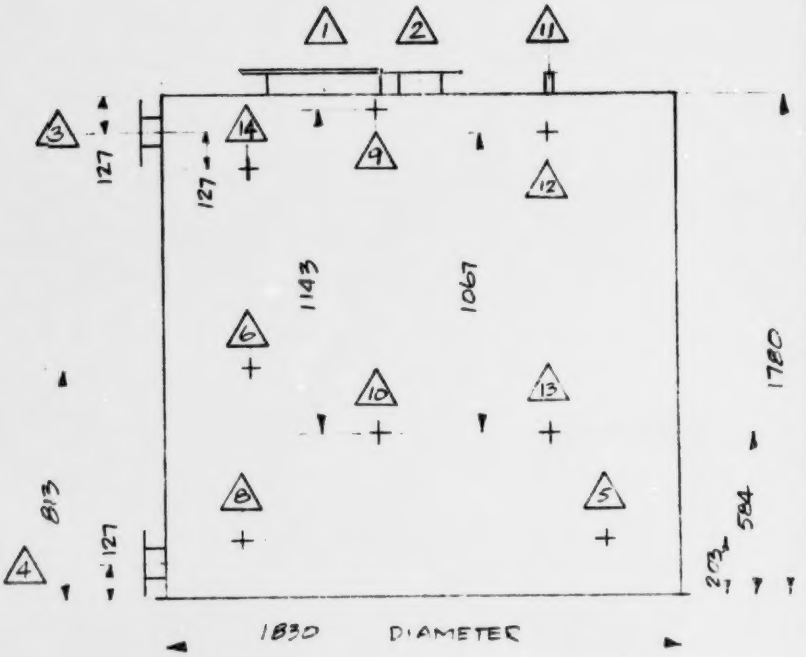
7.0 DRAWINGS AND MANUALS

The tenderer shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. Piping and support connections should be clearly indicated.

Prior to shipment, the successful tenderer shall submit one (1) reproducible and three (3) certified copies of all required drawings.

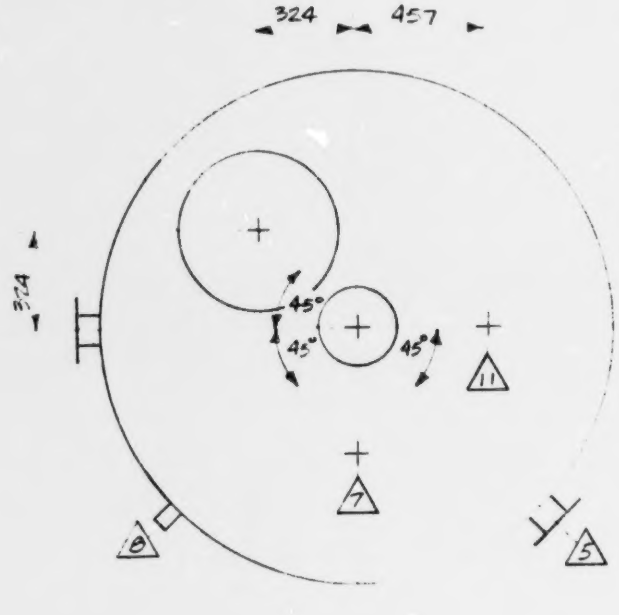
8.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.


1
2
11
3
14
9
12
127
127
1143
1067
6
10
13
1780
813
8
5
584
4
127
203
1830 DIAMETER

NOZZLE LIST

REF	SIZE	DESCRIPTION
1	400	MANHOLE
2.	150	FLANGED INLET
3.	50	NIPPLE OVERFLOW
4	50	NIPPLE DRAIN
5.	100	FLANGED SUCTION
6.	65	HALF COUPLING
7.	50	VENT
8.	50	NIPPLE - SUCTION
9	40	HALF COUPLING
10	40	HALF COUPLING
11	25	NIPPLE - INLET
12	20	HALF COUPLING
13	20	HALF COUPLING
14	65	HALF COUPLING


324
457
324
45°
45°
45°
11
7
8
5

(All dimensions in mm)

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE		DATE	
DRAWN		83-09-08	
CHECK			
APP'D.			

COOLING TOWER SUMP
ARRANGEMENT

A 0243 SK 153-1

SCHEDULE I - SCHEDULE OF PRICES

COOLING TOWER SUMP

1.	Cooling tower sump as described in the specification, FOB point of sale		$ ________
2.	Canadian Customs Duty _____ % of $ ________		$ ________
3.	Transportation to site		$ ________
		TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

COOLING TOWER SUMP

1.0 SPECIFICATIONS

Manufacturer's name ______________________________

Vendors name ______________________________

Tank shell material ______________________________

Shell thickness ____________ mm

Type of coating ______________________________

Thickness of coating ____________ mm

Anchor bolt diameter ____________ mm

Total weight ____________ kg

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ weeks

161-1

BAGHOUSE

161-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 161-1
ACCOUNT NO. 0243-161

SPECIFICATION FOR DUST COLLECTOR

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) fabric filter dust collector (baghouse) for the final clean-up of fluidized bed combustor flue gas.

2.0 SCOPE OF WORK

The Vendor shall fabricate, shop test and deliver one (1) dust collector as specified herin, which shall include but not be limited to the following:

- shop assembled baghouse complete with casing, base and supports
- gasketed and hinged, quick-release access doors
- flanged inlet and outlet connections
- filter bags, bag clamps, grounding strips
- single dust collection hopper with hand-operated gate
- automatic, pulse-jet bag cleaning system complete with timer, solenoids, cylinders and valves
- interconnecting compressed air piping at unit
- factory applied insulation and cladding
- shop applied primer and paint
- any special tools required for installation and/or maintenance

3.0 OPERATING CONDITIONS

3.1 Dust Laden Gas Properties

Moisture	4-26 mole %
Dust Load	48-79 gram/Am^3
Gas Volume	
Standard	0.38 sm^3/s
Actual	0.59 Am^3/s
Gas Temperature	
Normal	177°C
Maximum	260°C

3.2 Flyash Size Distribution

MAXIMUM		MINIMUM	
% Passing	Size, u	% Passing	Size, u
90	100	100	100
50	40	99	50
20	20	50	10
2	5	20	5
1	3	8	2

3.3 Design Data

Design pressure	-6.2 kPa (g)
Allowable pressure drop	
- Nominal	1.0 kPa (g)
- Maximum	1.5 kPa (g)
Gross air: cloth ratio	not less than 3.5:1
Operating duty	2,000 hrs. annually

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- flue gas inlet flange
- clean gas outlet flange
- dust removal gate
- compressed air connection
- electrical terminal box

5.0 DESIGN CONDITIONS

5.1 The baghouse will be installed inside a heated building.

5.2 Electrical power will be supplied at 115 and 230 V, 1-phase, 60 Hz.

5.3 Compressed air shall be supplied at 620 kPag.

6.0 TECHNICAL REQUIREMENTS

6.1 Overall height shall not be exceed 2400 mm.

6.2 The (single) baghouse dust collection hopper shall be sized to fit a 100 mm diameter rotary air lock (or minimum size available).

6.3 Bag cleaning system controls shall be suitable for mounting in the face of the Owner's remote control panel.

7.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Pollution Control Association	APCA
Canadian Standards Association	CSA
Conveyor Equipment Manufacturers Association	CEMA
National Electrical Manufacturers Association	NEMA

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic for the automatic bag cleaning system shall also be submitted with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

DUST COLLECTOR

1.	One (1) dust collector as described in the specification, FOB point of sale	$ ________
2.	Canadian Customs Duty (where applicable) _____ % of $ ________	$ ________
3.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA
DUST COLLECTOR

1.0 SPECIFICATIONS

Manufacturer's Name ______________________

Vendor's Name ______________________

Model and Type ______________________

Baghouse Dimensions ____________ mm

Unit Total Weight ____________ kg

Inlet Flange Size ____________ mm

Outlet Flange Size ____________ mm

Hopper Flange Size ____________ mm

Compressed Air Connection Size ____________ mm

Filter Access (Side/Top) ____________

Insulation Thickness ____________ mm

Filter Material ____________

Filter Material Temp. Limit ____________ °C

Bag Dimensions ____________ mm

Filter Area ____________ m^2

Air: Cloth Ratio ____________

Compressed Air Requirement ____________ m^3/s

Control power requirements ______ VA _____ V ____ phase

Electrical Requirement ____________ kW

Maximum Design Pressure ____________ kPa

Actual Pressure Drop ____________ kPa

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ______________ months

161-2

FLYASH RECYCLE ROTARY VALVE

161-2

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 161-2
ACCOUNT NO. 0243-161

SPECIFICATION FOR FLYASH RECYCLE ROTARY VALVE

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) rotary airlock valve to meter flyash from a baghouse into a pneumatic conveying system.

2.0 SCOPE OF WORK

The Work includes the fabrication, shop testing and delivery of one (1) rotary airlock valve as specified herein which shall include, but not be limited to the following:

- drop-through, rotary airlock valve
- shallow pocket, shrouded rotor
- rotor and valve body fabricated with abrasion resistant materials
- round, flanged inlet and outlet
- outboard bearings
- variable speed drive complete with motor, reducer, drive chains, guards and base plates
- pipeline adaptor for discharge piping

3.0 OPERATING CONDITIONS

Flyash bulk density	565 - 645 kg/m^3
Flyash particle size -	
Maximum	90% passing 100 microns 50% passing 40 microns 20% passing 20 microns 2% passing 5 microns 1% passing 3 microns
Minimum	100% passing 100 microns 99% passing 50 microns 50% passing 10 microns 20% passing 5 microns 8% passing 2 microns
Flyash characteristics	free flowing, abrasive, aerates
Flyash feed rate	0 - 82 kg/h

Temperature -	
Normal	177°C
Design	260°C
Airlock differential pressure	62 kPa (g)
Airlock inlet and discharge size	100 mm dia.
Pipeline size	32 mm dia.

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- inlet flange
- discharge flange
- electrical terminal box on drive.
- pipeline inlet and discharge connections
- speed indicator and operators controls
- drive controller.

5.0 DESIGN DATA

5.1 The airlock will meter flyash collected in the baghouse hopper into a positive pressure pneumatic flyash conveying system for reinjection into a pilot scale fluid bed combustor.

5.2 The airlock will be installed at the outlet of a baghouse which is to be situated in a heated building.

6.0 TECHNICAL REQUIREMENTS

6.1 A manually controlled variable speed drive is to be furnished so that the flyash recycle rate may be varied according to operational requirements.

6.2 Provision should be made to vent blowback air from returning empty pockets in order to ensure flyash flow from the baghouse hopper.

7.0 VARIABLE SPEED DRIVES

7.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

7.2 The motor shall be totally enclosed. Its temperature rise shall not be greater than for class B insulation. It shall be equipped with a removable drain plug.

7.3 Motors with permanent magnet fields shall be supplied where feasible.

7.4 The drive controller shall be contained in an EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

7.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

7.6 The following accessories shall be provided:

a) Pickup for speed indicator.

7.7 The following operators controls shall be provided:

a) Speed adjusting potentiometer
b) Start-stop switch
c) Speed indicator, 2% accuracy

7.8 Electrical power will be supplied at 115 V and 230 V 1-phase.

8.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

9.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

10.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

11.0 DRAWINGS AND MANUALS

The bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be included with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

12.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

FLYASH ROTARY AIRLOCK VALVE

1.	**One (1) rotary airlock valve as described in the specification, FOB point of sale**	**$ __________**
2.	**Canadian Customs Duty (where applicable)** **_____ % of $ __________**	**$ __________**
3.	**Transportation to site**	**$ __________**
	TOTAL	**$ __________**

SCHEDULE II - TECHNICAL DATA

FLYASH RECYCLE ROTARY VALVE

1. SPECIFICATIONS

Manufacturer's name ____________________

Vendor's name ____________________

Airlock model and type ____________________

Airlock weight ____________________ kg

Airlock outside dimensions ____________________ mm

Flange size ____________________ mm

Capacity - minimum ______ m^3/rev @ rpm

maximum ______ m^3/rev @ rpm

Airlock motor -

- Manufacturer ____________________
- Enclosure type ____________________
- Output ____________________ kW
- Speed ____________________ rpm
- Temperature rise ____________________ °C
- Frame size ____________________

Airlock drive -

- Type ____________________
- Manufacturer ____________________
- Speed Ratio ____________________
- Power supply voltage ________ VA ______ V ____ phase

2. LIST OF ALTERNATIVES AND EXTRAS

____

____

____

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____

____

3. DELIVERY

Time required for manufacture and shipment from receipt of order ________________ months

162-1

FLYASH RECYCLE PIPING

162-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 161-3
ACCOUNT NO. 0243-161

SPECIFICATION FOR FLYASH RECYCLE SYSTEM

1.0 REQUIREMENT

A tender is invited for the supply of a pneumatic conveying system to transport flyash from a baghouse hopper to a pressurized combustor.

2.0 SCOPE OF SUPPLY

One flyash recycle system, as shown on Sketch 161-3, which shall include, but not be limited to the following:

- flyash conveying pipe and fittings
- three-way diverter valve complete with cylinder operator

Note - a variable speed drop-through rotary airlock valve and pipline adaptor are described separately in specification 161-2. An expansion joint and manual gate valve (not included in scope) will be installed at the combustor end of the system.

3.0 OPERATING CONDITIONS

Material	Hot, dry flyash from the combustion of wood, coal and coke, plus sulphated limestone
Material bulk density	600 kg/m^3 (37 lb/ft^3)
Material feed rate	Variable, from 0-82 kg/h (0-37 lb/h)

(The balance of material properties are given in Section 3.0 of Inquiry 161-2.)

Conveying air pressure	Maximum 51.6 Pag (7.5 psig)
Conveying air temperature	57°C (135°F)
Combustor back pressure	Variable, from 13.8 - 34.5 kPag (2 - 5 psig)
Combustor temperature	Variable to 1100°C (2012°F)
Pipeline temperature	100 - 200°C (200 - 400°F)

4.0 TERMINAL POINTS

- material inlet to rotary valve
- conveying air inlet to pipeline adapter
- pipe outlet at sample line
- pipe flange connection (2" dia., 150 lb) at combustor
- electrical terminal box on drive
- speed indicator and remote operators controls for variable speed drive
- drive controller

5.0 TECHNICAL REQUIREMENTS

5.1 The system will recycle a variable quantity (manually selected) of flyash from the baghouse hopper back to the combustor. The recycle rate will be controlled by the rotary valve speed.

5.2 Alternate collection will be by conveying the flyash directly to a sealed and vented sample drum.

5.3 Rotary valve speed will be controlled by a speed adjusting potentiometer, to be located in the operators control room.

5.4 Conveying airflow will be measured and recorded. Flow control is provided by a manually controlled butterfly valve.

5.5 Technical requirements for the variable speed drive are included in Section 7.0 of Inquiry 161-2.

5.6 Critical dimensions are shown on sketch 161-3.

6.0 INFORMATION REQUESTED

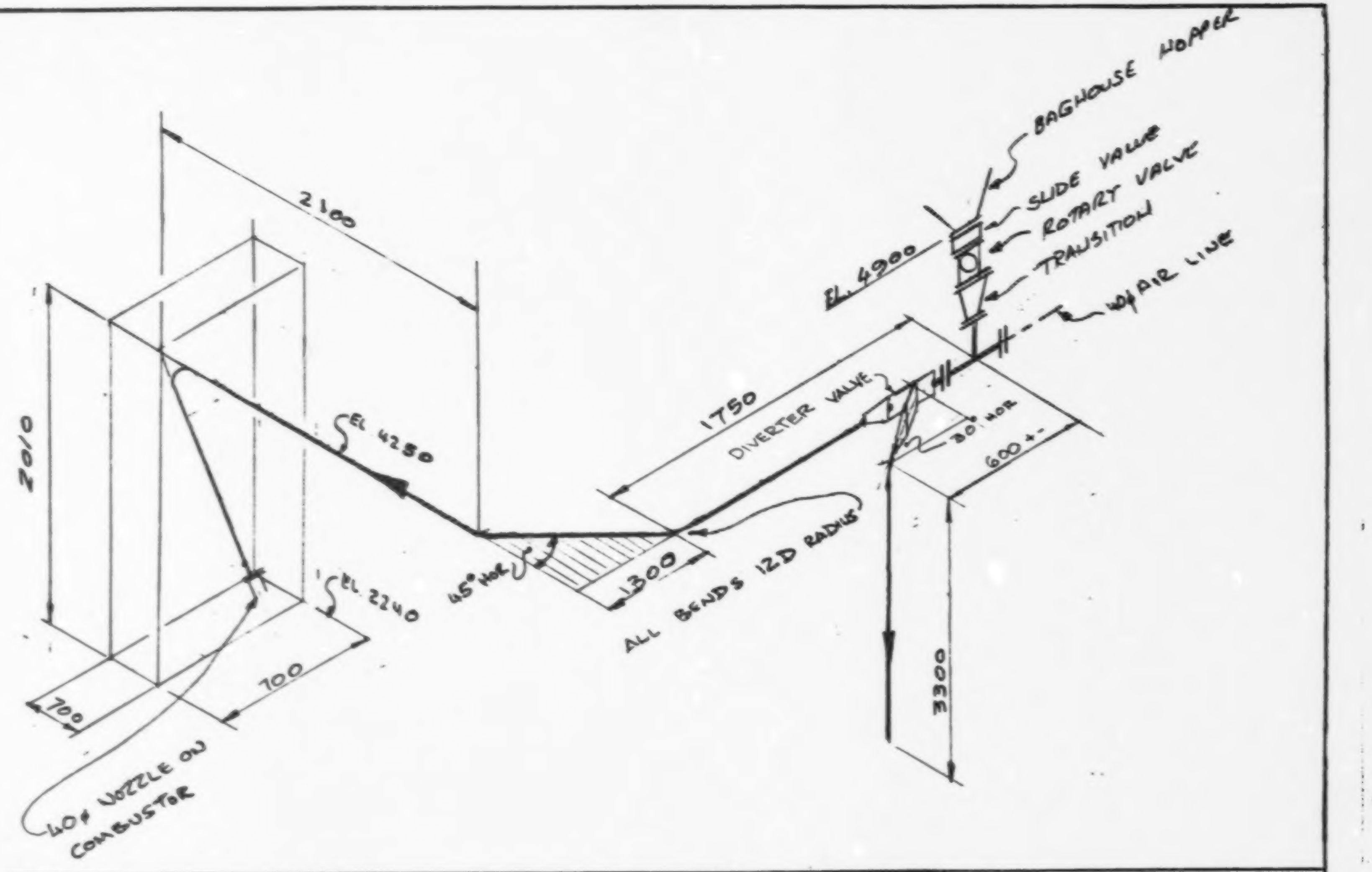
6.1 Budget price, FOB Ottawa.

6.2 Technical data for rotary valve as detailed in Schedule I and II of Inquiry 161-2.

6.3 Airflow requirement.

6.4 Pipe size.

6.5 Total pressure drop.


BAGHOUSE HOPPER
SLIDE VALVE
ROTARY VALVE
TRANSITION
40φ AIR LINE
EL. 4900
DIVERTER VALVE
30° HOR
600 +-
1750
3300
ALL BENDS 12D RADIUS
1300
45° HOR
2100
EL. 4250
EL. 2240
2010
700
700
40φ NOZZLE ON COMBUSTOR

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY, MINES & RESOURCES
CANADA

integ
Intercontinental Engineering Ltd

ASH RECYCLE LINE

B 0243 SK 161-3

171-1

I.D. FAN

171-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 171-1
ACCOUNT NO. 0243-171

SPECIFICATION FOR INDUCED DRAFT FAN

1.0 REQUIREMENT

Tenders are invited for the supply of one induced draft fan.

2.0 SCOPE OF WORK

The work includes the supply, shop testing and delivery of one induced draft fan as specified herein, which shall include but not be limited to the following:

- fan complete with drive and motor on an integral base
- flanged inlet
- flanged outlet
- shaft seal
- cooling wheel
- flexible coupling
- coupling guard
- shaft and bearing guard, with extended grease lines

3.0 OPERATING AND DESIGN CONDITIONS

Inlet temperature:

- normal	177°C	(350F)
- design	260°C	(500F)

Discharge pressure: 8.7 kPag (35 in WC)

Volume (normal operation):

- mass	0.474	kg/s	
- volume (actual)	0.586	Am^3/s	(1,247 Acfm)
- volume (standard)	0.383	sm^3/s	(816 scfm)

Density (177°C): 0.809 kg/Am^3

4.0 DESIGN DATA

4.1 Site elevation (Ottawa) is 103 m ASL

4.2 Ambient design temperatures are - summer: 30 °C
- winter: -25 °C

4.3 The fan shall handle unfiltered fluegas from a pilot scale combustor and discharge to a stack.

5.0 TECHNICAL REQUIREMENTS

5.1 Accoustical protection shall be provided to maintain maximum noise level of 85 dBA at 1 m.

5.2 The drive motor shall be 575 V, 3-phase, totally enclosed. Its temperature rise shall not be greater than for class B insulation. It shall be equipped with a removable drain plug.

5.3 The fan and accessories shall be supplied totally assembled, including all lubrication and local cooling piping.

6.0 ALTERNATIVES AND EXTRAS

The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

7.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

Air Moving and Conditioning Association	AMCA
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

8.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the Contract Documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

9.0 DRAWINGS AND MANUALS

The tenderer shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied and a fan performance curve. The drawing shall show all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated.

Prior to shipment, the successful tenderer shall submit one (1) reproducible and three (3) copies of all required drawings, including arrangement, layout, control schematic, wiring diagrams, performance curves, and specification sheets. All of these drawings and specifications shall be certified.

The successful tenderer shall also supply six (6) copies of maintenance and operating manuals.

10.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.

SCHEDULE I - SCHEDULE OF PRICES

INDUCED DRAFT FAN

1.	Induced draft fan as described in the specification, FOB point of sale	$ ________
2.	Canadian Customs Duty _____ % of $ __________	$ ________
3.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

INDUCED DRAFT FAN

1.0 SPECIFICATIONS

Manufacturer's name ____________________

Vendors name ____________________

Model and type ____________________

Volume ____________ m^3/s

Discharge pressure ____________ kPa(g)

Blower RPM ____________

Diameter of suction ____________ mm

Diameter of discharge ____________ mm

Maximum power consumption ____________ kW

Minimum flow ____________ m^3/s

Maximum noise level ____________ dBA

Drive type and specification ____________

Motor

- Manufacturer ____________
- Enclosure type ____________
- Power output ____________ kW
- Speed ____________ rpm
- Temperature rise ____________ ^oC
- Frame size ____________

Net weight ____________ kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ **months**

173-1

STACK

173-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 173-1
ACCOUNT NO. 0243-173

SPECIFICATION FOR STEEL STACK

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) steel stack for a pilot scale solid fuel combustor.

2.0 SCOPE OF WORK

The work includes the fabrication and delivery of one (1) steel stack as specified herein, which shall include but not be limited to the following:

- One double shell insulated steel stack
- Supporting guy wires and anchor plates
- Baseplate
- Lightning protection system
- Roof collar
- Support collar
- Attachment on stack for roof flashing
- Attachment on stack for guy wires
- Truncated outlet cone
- Access cleanout door
- Breeching penetration
- One (1) sample penetration with blind flange
- Any special tools required for installation or maintenance
- Shop coats of primer and enamel paint
- Additional primer and enamel paint for field touch up
- Erection instructions

3.0 OPERATING CONDITIONS

Material exhausted -		Fluegas from combustion of solid fossil fuels.
Gas temperature	(normal) -	177°C
	(maximum) -	260°C
Elevation:	ground level -	100 m
	base of stack -	107.7 m
Height of stack -		12.5 m

Process Conditions	Normal	Design
Mass flow (kg/s)	0.304	0.474
Volume flow (Am^3/s)	0.376	0.586
Temperature (°C)	177	177
Outlet velocity (m/s)	15	-
Draft at base of stack	Slightly positive	

Location: Ottawa, Ontario

4.0 TECHNICAL REQUIREMENTS

4.1 The stack will rest on structural steel within the building and will extend up through the roof, as shown on sketch 0243 SK 173-1, sheets 1 and 2, included with this specification.

4.2 Above the roof, the stack will be laterally supported by guy wires.

4.3 A metal thimble shall be provided, which extends 230 mm above and below the roof opening.

4.4 The stack shall be designed to withstand seismic forces and wind pressures in accordance with the requirements of the National Building Code of Canada and supplements. The site is Ottawa, Ontario.

4.5 The stack shall be fabricated in convenient lengths for shipping. The lengths will be chosen to minimize field erection work.

4.6 Fittings will be provided and mounted on the stack for connecting guy wires and roof flashing.

4.7 A structural support collar to be clipped to building steel beneath the roof shall be provided. Connection details shall be provided with the tender layout drawing.

4.8 The stack outer shell, flue shell and stack flanges, baseplate, and ring stiffeners and all component parts to be ASTM A36 steel.

4.9 The flue shell and component parts shall be of sufficient thickness to resist all wind and earthquake loads.

4.10 Allowable construction tolerances:

- Diametral out of roundness (paired)	- 3 mm plus or minus
- Vertical waviness in 3 m	- 1.5 mm
- Local dents in plates	- no deeper than one half of plate thickness.

4.11 The stack exterior surfaces shall be shop treated as follows:

1) All exterior surfaces shall be thoroughly cleaned of all rust, scale, dirt, grease, oil and other foreign matter in accordance with the latest revision of SSPC-SP6-63. Commercial Sandblast Cleaning.

2) One coat of inorganic zinc primer shall be applied to a thickness of 0.08 mm (3 mils).

3) One coat of hi-build epoxy finish coat shall be applied to a thickness of 0.13 mm (5 mils) color to be selected by the Owner after award of Contract.

4.12 The contractor shall furnish sufficient primer and epoxy finish coat to complete painting and touch up of the completed stack in the field.

4.13 The contractor shall furnish complete erection and painting instructions with the equipment.

5.0 CODES AND STANDARDS

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario, and with the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing Materials	ASTM
Canadian Standards Association	CSA
American National Standards Institute	ANSI
Steel Structures Painting Council	SSPC
National Building Code of Canada	NBC
Canadian Electrical Manufacturers Association	CEMA

6.0 ALTERNATIVES AND EXTRAS

The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

7.0 WARRANTY

The Contractor shall warrant that all workmanship, materials and equipment (to the extent supplied by Contractor only) incorporated into the Work shall comply in all respects with the contract documents and shall be free from defects (including latent defects); the Contractor shall correct, at Contractor's expense, any defects in the Work (including latent defects) due to faulty materials or equipment supplied by Contractor or Contractor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

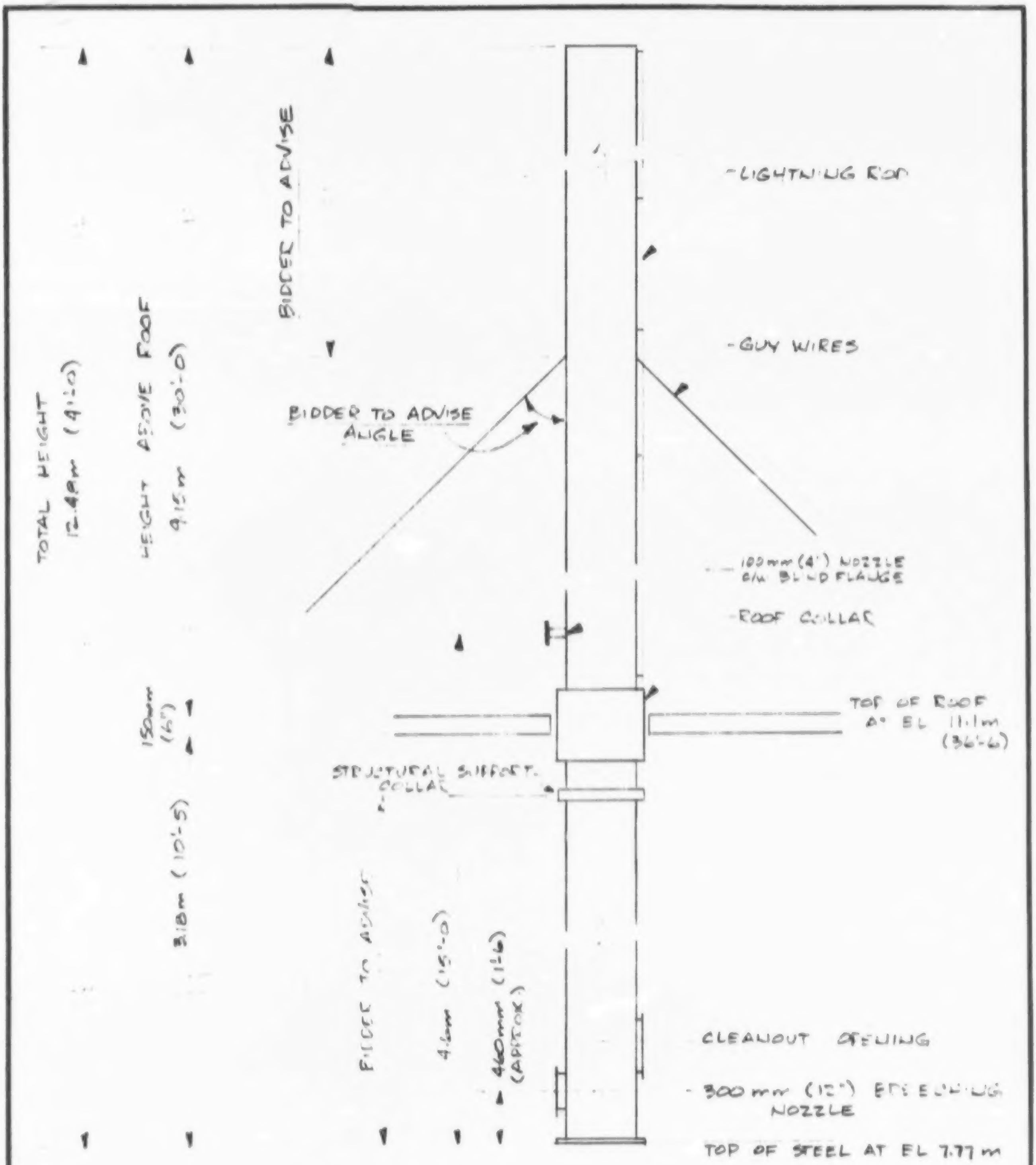
8.0 DRAWINGS AND MANUALS

The tenderer shall submit with his tender an arrangement drawing of the equipment including all the accessories supplied. The drawing shall show all critical size and dimensions and all pertinent data of the equipment. All electrical and support connections should be clearly indicated as well as a recommended detail of the roof flashing.

Prior to shipment, the successful tenderer shall submit one (1) reproducible and three (3) certified copies of all required drawings, including arrangement and details.

9.0 INFORMATION REQUIRED WITH TENDER

In addition to the information previously requested herein attached Schedules I and II shall be completed and included with the tender.


TOTAL HEIGHT 12.49m (41'-0)
HEIGHT ABOVE ROOF 9.15m (30'-0)
BIDDER TO ADVISE
BIDDER TO ADVISE ANGLE
LIGHTNING ROD
GUY WIRES
100mm (4") NOZZLE c/w BLIND FLANGE
ROOF COLLAR
TOP OF ROOF AT EL 11.1m (36'-6)
150mm (6")
STRUCTURAL SUPPORT COLLAR
3.18m (10'-5)
BIDDER TO ADVISE
4.6m (15'-0)
460mm (1'-6) (APPROX.)
CLEANOUT OPENING
300mm (12") BREECHING NOZZLE
TOP OF STEEL AT EL 7.77m

**ENERGY, MINES AND RESOURCES
CANADA**

**ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY**

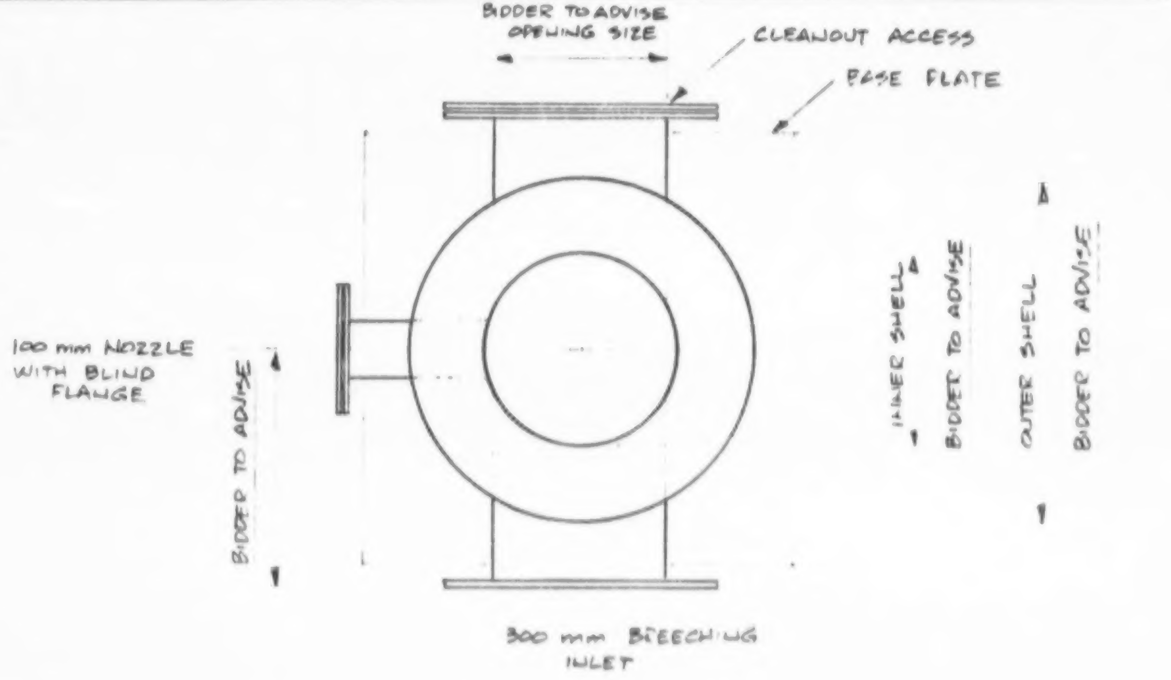
integ
Intercontinental Engineering Ltd

SCALE		DATE	
DRAWN		AUG 30/8	
CHECK			
APP'D.			

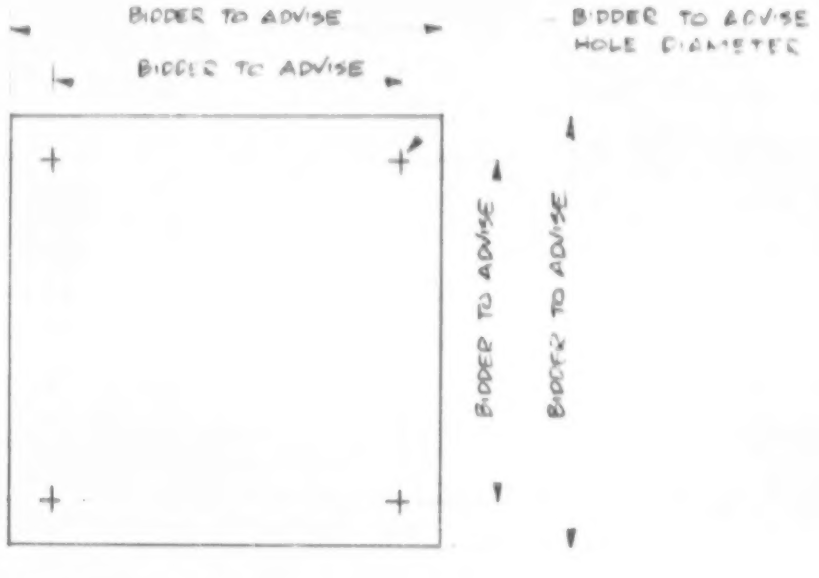
STACK - ELEVATION

SHEET 1

A	0243	SK	173-1	0


BIDDER TO ADVISE
OPENING SIZE
CLEANOUT ACCESS
BASE PLATE
100 mm NOZZLE
WITH BLIND
FLANGE
BIDDER TO ADVISE
INNER SHELL
BIDDER TO ADVISE
OUTER SHELL
BIDDER TO ADVISE
300 mm BREECHING
INLET

SECTIONAL VIEW OF STACK


BIDDER TO ADVISE
BIDDER TO ADVISE
BIDDER TO ADVISE
HOLE DIAMETER
BIDDER TO ADVISE
BIDDER TO ADVISE

STACK BASE PLATE

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

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SCALE		DATE
DRAWN		
CHECK		
APP'D.		

STACK - DETAILS

SHEET 2

A	0243	SK	173-1	0

SCHEDULE I - SCHEDULE OF PRICES

STACK

1.	Steel stack as described in the specification, FOB point of sale	$ __________
2.	Canadian Customs Duty _____ % of $ __________	$ __________
3.	Transportation to site	$ __________
	TOTAL	$ __________

SCHEDULE II - TECHNICAL DATA

STACK

1.0 SPECIFICATIONS

Manufacturer's Name ______________

Vendors Name ______________

Outer shell diameter ______________ mm

Outer shell thickness ______________ mm

Outer shell material ______________

Inner shell diameter ______________ mm

Inner shell thickness ______________ mm

Inner shall material ______________

Insulation type ______________

Insulation thickness ______________ mm

Roof collar diameter ______________ mm

Anchor bolt diameter ______________ mm

Guy wire material and size ______________ mm

Access cleanout door size ______________ mm

Stack weight ______________ kg

Section length (as shipped) ______________ m

Required roof opening ______________ mm

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

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3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

211-1

FUEL STORAGE AND METERING SYSTEM

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 211-1
ACCOUNT NO. 0243-211

SPECIFICATION FOR FUEL STORAGE AND METERING SYSTEM

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) fuel storage and metering system for a pilot scale fluidized bed combustor.

2.0 SCOPE OF WORK

The Work includes fabrication, shop testing and delivery of one (1) fuel storage handling system as shown on drawing 0243 SK 211-1, included with this specification, and as specified herein.

The system shall include, but not be limited to, the following, to make it a complete working system:

- Fuel storage bin complete as follows:
  - internal bin coating if required
  - high and low level switches
  - one (1) nominal 50 mm sampling port with valve in bin side wall
  - inspection and auxiliary loading door located on top of bin, complete with hinges, gasket and latch
  - flanged inlet chute at top of bin
  - manually operated slide gate valve at bin inlet.
  - vent with valve and filter
- Vibrating bin discharger including:
  - exciter assembly of such a type that a wide range of forces may be quickly and easily selected
  - motor and drive including belts, guards and base plates
  - remote controls
- Manual slide gate valve at bin discharger outlet.
- Flexible connection at valve discharge.
- Belt type gravimetric weighfeeder complete as follows:
  - flanged inlet connection (and chute if required)
  - outlet diverter/sampling valve
  - manual slide gate at valve discharge
  - local control console

  - controls and instruments for mounting in Owner's remote control panel
  - power module containing SCR drive
  - variable speed motor and drive
  - dust tight enclosure with pressurizing air connection

- Rotary valve at sampling gate discharge complete with constant speed motor and drive.

- Special tools required for installation and/or maintenance.

- Shop assembly on a structural frame.

- Standard shop coats of pri[illegible] and paint on all components.

3.0 OPERATING CONDITIONS

3.1 Fuel Properties

	Fluid Coke	Coal Rejects	Wood Chips	Peat
Moisture (%)	3.6	20.1	60	57.5
Max. Surface Moisture (%)	-	7.0	-	-
Density (kg/m^3)	800	960	160	170
Size Distribution (%)				
50 mm/38 mm	-	-	10.64	-
38 mm/25 mm	-	-	15.97	-
25 mm/19 mm	-	-	34.74	-
19 mm/13 mm	-	3.04	30.71	-
13 mm/6 mm	-	20.20	5.88	-
6 mm/3 mm	-	28.34	2.06	-
3 mm/16 mesh	-	16.90	-	-
16 mesh/100 mesh	-	9.52	-	-
28 mesh/100 mesh	-	22.00	-	100
100 mesh/0	100	-	-	-

3.2 System Capacity & Requirements

Maximum feed rate	0.083 kg/s (based on coal rejects)
Design feed rate	0.095 kg/s
Turndown	20:1
Bin volume	2.65 m^3
Operating pressure	34 kPa g

3.3 Operating Duty

The system shall store and meter fuel to a pilot scale fluidized bed combustor operating at a maximum temperature of 1100°C and a variable pressure, ranging to 52 kPag. The weighfeeder shall discharge into a screw conveyor which shall feed via a rotary airlock into the combustor.

Some backpressure should be experienced from the combustor, so a rotary airlock will be provided to isolate the weighfeeder. The screw feeder will also be equipped with a rotary airlock and pressurized.

The system is expected to operate approximately 2,000 hrs. annually.

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- slide gate at bin inlet
- slide gate at sampling and diverter valve discharge
- electrical terminal box at level switches
- electrical terminals on weighfeeder local control console
- electrical terminals on weighfeeder drive controller
- controls and instruments for remote control panel
- structural mounting flanges.
- electrical terminal box on drive motors.

5.0 DESIGN DATA

5.1 The system will be installed in a heated building.

5.2 Allowable overall height of the system is 2.85 m.

6.0 TECHNICAL REQUIREMENTS

General

6.1 All local electrical controls and motors shall be CSA approved for Class II, Division 1, Group F.

6.2 Electrical power shall be available at 575 V, 3-phase and 115 V and 230 V, 1-phase.

6.3 The system shall be assembled and shop tested, then disassembled and crated for shipment.

6.4 The assembly dimensions are shown on drawing 0243 SK 211-1. If at all possible, the overall height shall be reduced to the minimum practical, as headroom is critical. However, the basic bin size (1500 mm diameter by 1500 mm cylindrical height) can not be changed.

Fuel Storage Bin

6.5 The fuel storage bin shall be fabricated from mild steel and shall be suitably braced, stiffened and supported on external surfaces only, and shall be designed to resist the live and dead loads to which it may be subjected during normal operation.

6.6 A coating shall be applied to the interior of the bin, if necessary, to ensure material flow.

6.7 The bin inspection door shall have a quick release latching mechanism.

6.8 The bin shall be dust tight and equipped with purge air connections for pressurization to 34 kPag from the Owner's 100 kPag air supply.

6.9 A 25 mm vent with valve and filter shall be provided on the top of the bin.

Bin Discharger

6.10 The discharger shall enhance the flow of the materials described in Section 3.1, such that no flow problems will be experienced throughout the operating range of the system.

6.11 Remote controls shall be suitable for flush mounting in the face of the Owner's remote control panel.

Weighfeeder

6.12 The weighfeeder shall be totally enclosed in a dust tight enclosure.

6.13 Scrapers and provision for removal of any accumulated dust shall be included.

6.14 Two modes of feeder control are required for controlled feeding and monitoring.

a) Automatic - feeder controlled remotely by 4-20 milliamp demand signal from Owner's process controller.

b) Manual - feeder controlled by a setpoint manually selected on the feeder local control console.

6.15 The local control console shall include but not be limited to the following functions:

- auto-manual selector switch
- start-stop switch
- setpoint selector
- digital mass flow indicator

6.16 The remote controls shall be suitable for mounting in the face of the Owner's control panel, and shall include but not be limited to the following functions:

- digital mass flow indicator
- start-stop switch with run light.
- under/over-feed alarm indicators
- auto-manual status indicators.

6.17 Additional terminals shall be provided for an external trip input signal.

6.18 A 4-20 milliamp output signal shall be provided.

7.0 ALTERNATIVES AND EXTRAS

The Bidder is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

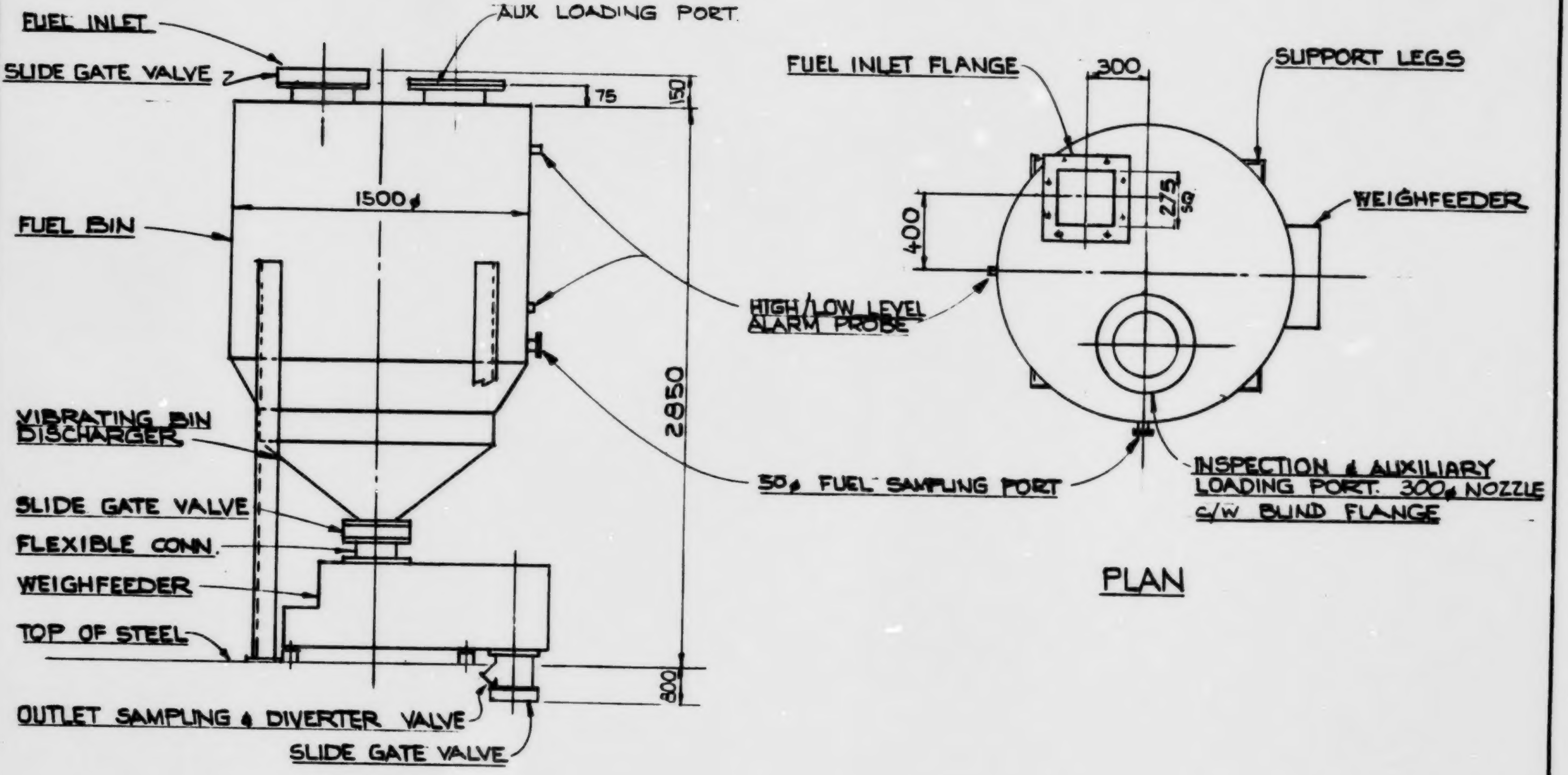
The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be submitted with bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.


FUEL INLET
SLIDE GATE VALVE
AUX LOADING PORT
75
150
1500 ϕ
FUEL BIN
HIGH/LOW LEVEL ALARM PROBE
2850
VIBRATING BIN DISCHARGER
50 ϕ FUEL SAMPLING PORT
SLIDE GATE VALVE
FLEXIBLE CONN.
WEIGHFEEDER
TOP OF STEEL
800
OUTLET SAMPLING & DIVERTER VALVE
SLIDE GATE VALVE
FUEL INLET FLANGE
300
SUPPORT LEGS
275 SQ
400
WEIGHFEEDER
INSPECTION & AUXILIARY LOADING PORT. 300 ϕ NOZZLE C/W BLIND FLANGE

PLAN

Design	Drawn	Check	Appd	Issued for	Date	Rev
	LR					

ENERGY MINES & RESOURCES
CANADA

integ
Intercontinental Engineering Ltd

FUEL STORAGE & FEED
GENERAL ARRANGEMENT

B 0243 · SK 211-1 0

SCHEDULE I - SCHEDULE OF PRICES

FUEL HANDLING SYSTEM

1.	One (1) fuel handling system as described in the specification, FOB point of sale	$ __________
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ __________
	TOTAL	$ __________

SCHEDULE II - TECHNICAL DATA

FUEL HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Bin Discharger Model and Type ______________________________

Weighfeeder Model and Type ______________________________

System total dimensions as package ______________ mm

Unit total weight as package ______________ kg

Bin height ______________ mm

Bin diameter ______________ mm

Discharger diameter ______________ mm

Discharger exciter type ______________________________

Discharger flows

- Minimum w/coal rejects ______________ kg/s
- Maximum w/coal rejects ______________ kg/s
- Minimum w/wood chips ______________ kg/s
- Maximum w/wood chips ______________ kg/s

Weighfeeder belt width ______________ mm

Weighfeeder flows

- Minimum w/coal rejects ______________ kg/s
- Maximum w/coal rejects ______________ kg/s
- Minimum w/wood chips ______________ kg/s
- Maximum w/wood chips ______________ kg/s

Weighfeeder outlet connection dimensions ____________ **mm**

Discharger motor

- **Enclosure type** ______________________________
- **Manufacturer** ______________________________
- **Model** ______________________________
- **Temperature rise** ____________ **°C**
- **Power output** ____________ **kW**
- **Frame size** ____________
- **Speed** ____________ **rpm**

Weighfeeder drive

- **Type** ______________________________
- **Manufacturer** ______________________________
- **Model** ______________________________
- **Speed ratio** ______________________________
- **Power rating** ____________ **kW**
- **Power supply requirements** ______ **VA** _____ **V** ____ **phase**

Weighfeeder motor

- **Enclosure type** ______________________________
- **Manufacturer** ______________________________
- **Power output** ____________ **kW**
- **Temperature rise** ____________ **°C**
- **Speed** ____________ **rpm**
- **Frame size** ____________

Control power requirements

- **Weighfeeder** ______ **VA** _____ **V** ____ **phase**

2.0 LIST OF ALTERNATIVES AND EXTRAS

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ______________ months

212-1

BUCKET ELEVATOR

212-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 212-1
ACCOUNT NO. 0243-212

SPECIFICATION FOR BUCKET ELEVATOR

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) centrifugal discharge belt-type, bucket elevator for the conveying of fuel to the fuel storage bin.

2.0 SCOPE OF WORK

The Work includes the fabrication, shop testing and delivery of one (1) bucket elevator as specified herein which shall include, but not be limited to, the following:

- abrasion resistant, high strength elevator belt
- abrasion resistant buckets
- sealed, dust-tight casing with access ports
- motor and drive assembly including base and guards
- horizontal flange inlet connection
- removable cover plate for inlet flange
- horizontal flange, discharge spout
- belt take-up assembly
- all bearings, shafts, etc.
- standard shop coat of primer and paint
- special tools required for installation and/or maintenance

3.0 OPERATING CONDITIONS

3.1 Fuel Properties

	Fluid Coke	Coal Rejects	Wood Chips	Peat
Total Moisture (%)	3.6	20.1	60	57.5
Max. Surface Moisture (%)	-	7.0	-	-
Density (kg/m^3)	800	960	160	170
Size Distribution (%)				
50 mm/38 mm	-	-	10.64	-
38 mm/25 mm	-	-	15.97	-
25 mm/19 mm	-	-	34.74	-
19 mm/13 mm	-	3.04	30.71	-
13 mm/6 mm	-	20.20	5.88	-
6 mm/3 mm	-	28.34	2.06	-
3 mm/16 mesh	-	16.90	-	-
16 mesh/100 mesh	-	9.52	-	-
28 mesh/100 mesh	-	22.00	-	100
100 mesh/0	100	-	-	-

3.2 Design Data

Elevator capacity	1 kg/s or 3.75 m^3/h (based on coal rejects)
Height to top of fuel bin	8350 mm
Operating duty	2,000 hrs. annually

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- inlet flange
- discharge spout flange
- electrical terminal box on motor
- structural support flanges

5.0 TECHNICAL REQUIREMENTS

5.1 The elevator will be installed in a heated building.

5.2 The allowable overall height of the bucket elevator is 9340 mm.

5.3 The bucket elevator will be fed by a portable filling hopper and loading chute (supplied by others).

6.0 ELECTRIC MOTORS

Electrical power will be supplied at 575 V, 3-phase.

Electric motor shall be totally enclosed, approved for Class II, Division 1, Group F hazardous locations.

7.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI

Canadian Standards Association	CSA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC
National Electrical Manufacturers Association	NEMA

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1. One (1) bucket elevator as described in the specification, FOB point of sale $ __________

2. Canadian Customs Duty (where applicable) _____ % of $ __________ $ __________

3. Transportation to site $ __________

TOTAL $ __________

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name ____________________

Vendor's Name ____________________

Model and Type ____________________

Casing size __________ mm

Total height __________ mm

Discharge height __________ mm

Shaft center distance __________ mm

Inlet flange dimensions __________ mm

Discharge spout flange dimensions __________ mm

Belt material ____________________

Belt width __________ mm

Bucket material ____________________

Bucket type ____________________

Elevator maximum capacity __________ m^3/h

Elevator motor

- Enclosure type ____________________
- Manufacturer ____________________
- Speed __________ rpm
- Power output __________ kW
- Temperature rise __________ °C
- Frame size __________

Elevator drive

- Type ______________________
- Manufacturer ______________________
- Model ______________________
- Speed ratio ______________________

2.0 LIST OF ALTERNATIVES AND EXTRAS

____

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

221-1
SORBENT STORAGE AND METERING SYSTEM

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 221-1
ACCOUNT NO. 0243-221

SPECIFICATION FOR LIMESTONE STORAGE AND METERING SYSTEM

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) limestone storage and metering system for a pilot scale fluidized bed combustor.

2.0 SCOPE OF WORK

The work includes the fabrication, shop testing, and delivery one (1) limestone storage and handling system as shown on drawing 0243 SK 221-1, included with this specification, and as specified herein. The system shall include but not be limited to, the following to make it a complete working system:

- Limestone bin complete as follows:
    - conical hopper bottom
    - hopper vibrator with cycle timer (if required)
    - internal bin coating (if required)
    - high and low level switches
    - one nominal 50 mm sampling port with valve in bin side wall
    - inspection and auxiliary loading door located on top of bin complete with hinges, gasket and latch
    - flanged inlet chute at top of bin
    - manual slide gate at bin inlet
- Manual slide gate at bin discharge
- Screw prefeeder at gate discharge complete with variable speed motor and drive
- Flexible connection at valve discharge
- Belt type gravimetric weighfeeder complete as follows:
    - flanged inlet connection (and chute if required)
    - outlet diverter/sampling valve
    - manual slide gate at valve discharge
    - local control console
    - controls and instruments for mounting in Owner's remote control panel
    - constant speed motor and drive

    - belt and pulley scrapers
    - dust tight enclosure

- Rotary valve at sampling gate discharge complete with constant speed motor and drive

- Special tools required for installation and/or maintenance.

- Shop assembly on a structural frame

- Standard shop coats of primer and paint on all components

3.0 OPERATING CONDITIONS

3.1 Material Properties

Material	Dry crushed limestone
Bulk density	1 600 kg/m^3

Size:

Maximum

Size (mm)	Wt. %
-6.00	100
6.00 - 4.75	9.78
4.75 - 3.35	14.50
3.35 - 2.36	17.20
2.36 - 1.70	11.40
1.70 - 1.18	9.10
1.18 - 0.85	6.80
0.85 - 0.25	13.23
-0.25	17.90

Minimum

Size (mm)	Wt. %
-1.0	100
0.3 - 0.1	50
-0.1	0

3.2 Design Data

Bin mass capacity	800 kg
Bin volume	0.5 m^3
Maximum feed rate	0.012 kg/s
Design feed rate	0.014 kg/s
Turndown (feedrate)	20:1

3.3 Operating Duty

The system shall store and meter limestone to a pilot scale fluidized bed combustor operating at a maximum temperature of 1100°C and a variable pressure, ranging to 52 kPag. The weighfeeder shall discharge into a screw conveyor which shall feed via a rotary airlock into the combustor.

Some backpressure should be experienced from the combustor, so a rotary airlock will be provided to isolate the weighfeeder. The screw feeder will also be equipped with a rotary valve and pressurized.

The system is expected to operate approximately 2,000 hrs. annually.

4.0 TERMINAL POINTS

The terminal points of this specification include:

- slide gate at bin inlet
- slide gate at sampling and diverter valve discharge
- electrical terminal box at level switches
- electrical terminals on weighfeeder local control console
- electrical terminals on weighfeeder drive controller
- controls and instruments for remote control panel
- structural mounting flanges
- electrical terminal box on drive motors

5.0 DESIGN DATA

5.1 The system will be installed inside a heated building.

5.2 Allowable overall height of the system is shown on SK-221-1.

6.0 TECHNICAL REQUIREMENTS

General

6.1 Electrical power shall be available at 575 V, 3-phase and 115 V and 230 V, 1-phase.

6.2 The motors shall be totally enclosed. Local controls shall be gasketted, dust tight, and control panel(s) shall be in EEMAC 12 (industrial use) enclosures.

6.3 The system shall be assembled and shop tested, then disassembled and crated for shipment.

6.4 The assembly dimensions are shown on drawing 0243 SK 221-1.

Limestone Storage Bin

6.4 The bin shall be fabricated from mild steel and shall be suitably braced, stiffened and supported on external surfaces only, and shall be designed to resist the live and dead loads to which it may be subjected during normal operation.

6.5 A coating shall be applied to the interior of the bin, if necessary, to ensure material flow.

6.6 A hopper vibrator shall be supplied, if necessary, to promote material flow from the bin.

6.7 The bin inspection door shall have a quick release latching mechanism.

6.8 The bin shall be dust tight.

6.9 A vacuum loading system cyclone separator (supplied by others) will be installed over the bin inlet opening.

Bin Discharger (if required)

6.10 The discharger shall enhance the flow of the materials described in Section 3.1, such that no flow problems will be experienced throughout the operating range of the system.

6.11 Remote controls shall be suitable for flush mounting in the face of the Owner's remote control panel.

Screw Prefeeder

6.12 The screw prefeeder valve shall control flow to the weighfeeder.

6.13 The variable speed drive will be interconnected to and controlled by the weighfeeder control via a master/slave ratio control. The valve shall be activated in both the automatic and manual modes of weighfeeder control.

6.14 The controls shall be mounted on the (local) control console for the weighfeeder.

6.15 Variable speed drive shall consist of dc electric motor with control circuitry to vary the armature voltage. Specified drive shall be ImPak Plus or MinPak Plus, supplied by Reliance Electric or approved equal. The dc drive motor shall be supplied with a permanent magnet field if feasible.

Weighfeeder

6.16 The weighfeeder shall be totally enclosed in a dust tight enclosure.

6.17 Scrapers and provisions for removal of any accumulated dust shall be included.

6.18 Two modes of feeder control are required for controlled feeding and monitoring:

a) Automatic - feeder controlled remotely by 4-20 milliamp demand signal from Owner's process controller.

b) Manual - feeder controlled by a setpoint manually selected on the feeder local control console.

6.19 The local control console shall include but not be limited to the following functions:

- auto-manual selector switch
- run-stop switch
- setpoint selector
- digital mass flow indicator

6.20 The remote controls shall be suitable for mounting in the face of the Owner's control panel, and shall include but not be limited to the following functions:

- digital mass flow indicator
- start-stop switch with run light
- under/over - feed alarm indicators
- auto-manual status indicators

6.21 Additional terminals shall be provided for an external trip input signal.

6.22 A 4-20 milliamp output signal shall be provided.

7.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
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Conveyor Equipment Manufacturers Association	CEMA
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Electrical and Electronic Manufacturer's Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

10.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall be furnished with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

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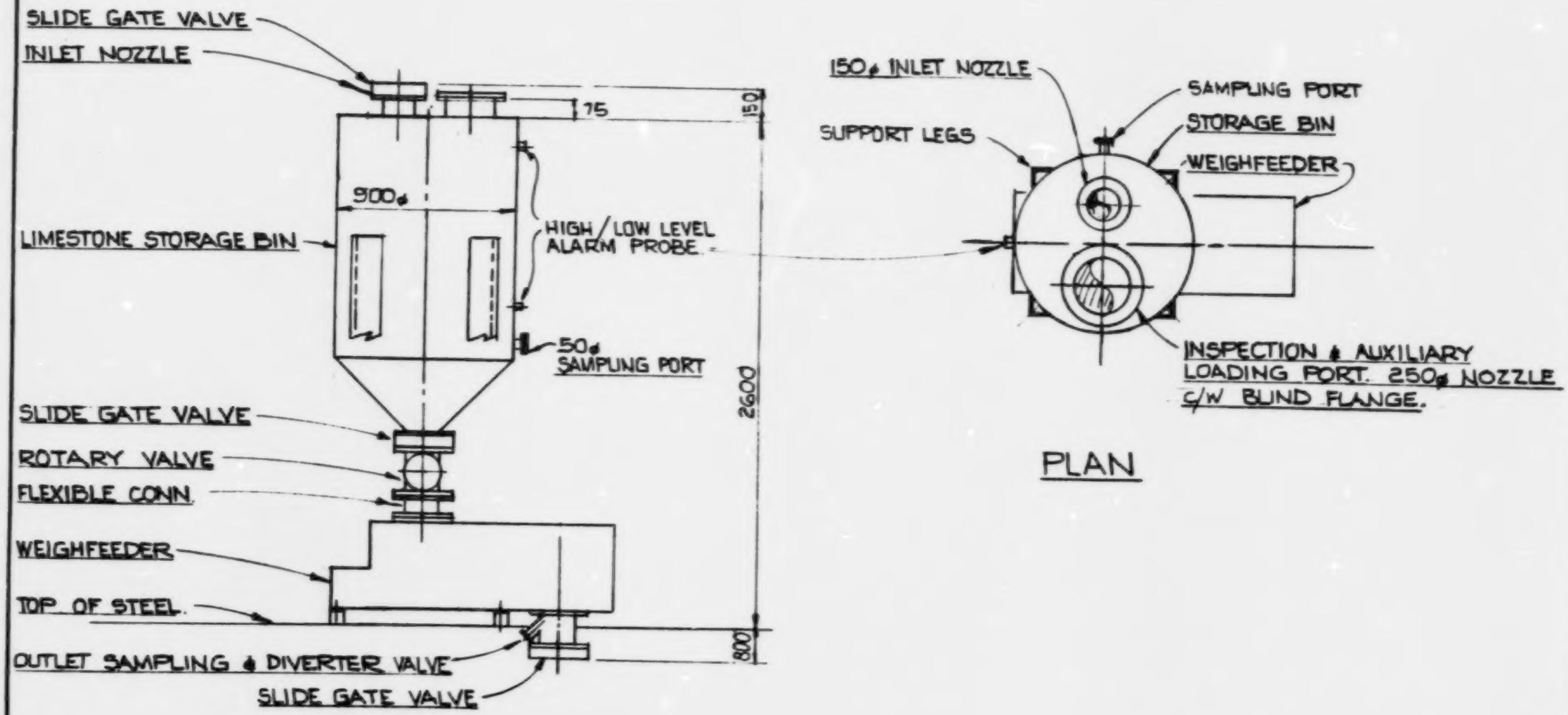
SLIDE GATE VALVE
INLET NOZZLE
75
150
900ø
LIMESTONE STORAGE BIN
HIGH/LOW LEVEL ALARM PROBE
50ø SAMPLING PORT
2600
SLIDE GATE VALVE
ROTARY VALVE
FLEXIBLE CONN.
WEIGHFEEDER
TOP OF STEEL.
800
OUTLET SAMPLING & DIVERTER VALVE
SLIDE GATE VALVE
150ø INLET NOZZLE
SAMPLING PORT
SUPPORT LEGS
STORAGE BIN
WEIGHFEEDER
INSPECTION & AUXILIARY LOADING PORT. 250ø NOZZLE C/W BLIND FLANGE.
PLAN

Design	Drawn	Check	Appd	Issued for	Date	Rev
	L.R					

ENERGY MINES & RESOURCES.
CANADA

LIMESTONE STORAGE & FEED
GENERAL ARRANGEMENT

B	0243	SK	221-1	0

SCHEDULE I - SCHEDULE OF PRICES

LIMESTONE HANDLING SYSTEM

1.	One (1) limestone handling system as described in the specification, FOB point of sale	$ ________
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ ________
3.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

LIMESTONE HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Weighfeeder Model and Type ______________________________

Rotary Valve Model and Type ______________________________

System total dimensions ____________ mm

System total weight ____________ kg

Bin height ____________ mm

Bin diameter ____________ mm

Bin lining or coating ______________________________

Rotary valve flows

- Minimum ____________ kg/s
- Maximum ____________ kg/s

Weighfeeder belt width ____________ mm

Weighfeeder flows

- Minimum ____________ kg/s
- Maximum ____________ kg/s

Weighfeeder outlet connection dimensions ____________ mm

Rotary valve drive

- Type ______________________________
- Manufacturer ______________________________
- Model ______________________________
- Speed Ratio ______________________________

Power supply requirements ______ VA _____ V ____ phase

Rotary valve motor

- Enclosure type ________________________________
- Manufacturer ________________________________
- Power output ______________ kW
- Temperature rise ______________ °C
- Speed ______________ rpm
- Frame size ______________

Weighfeeder drive

- Type ________________________________
- Manufacturer ________________________________
- Model ________________________________
- Speed ratio ______________
- Power supply requirements ______ VA _____ V ____ phase

Weighfeeder motor

- Enclosure type ________________________________
- Manufacturer ________________________________
- Power output ______________ kW
- Temperature rise ______________ °C
- Speed ______________ rpm
- Frame size ______________

Control power requirements ______________

- Weighfeeder ______ VA _____ V ____ phase

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture
and shipment from receipt of order ______________ months

222-1

PNEUMATIC CONVEYING SYSTEM

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 222-1
ACCOUNT NO. 0243-222

SPECIFICATION FOR PNEUMATIC CONVEYING SYSTEM

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) negative pressure, pneumatic conveying system.

2.0 SCOPE OF WORK

The Vendor shall supply, shop test and deliver one (1) pneumatic vacuum conveying system as specified herein which shall include, but not be limited to the following:

- positive displacement type blower
- blower drive with drive guard integrally mounted with the blower on a common base plate
- vacuum relief valve
- discharge silencer (supplied loose)
- vacuum gauge
- separator (cyclone collector)
- separator inlet and discharge pipeline transitions
- filter
- rotary airlock (for base of separator)
- airlock drive motor complete with guard, reduction unit, sprockets, chain, etc.
- rigid pickup or suction lance
- length of flexible hose to connect lance to stationary piping
- special tools required for installation and/or maintenance
- standard shop coats of primer and paint
- flexible connections and any other special connections and hardware required
- acoustical protection (if required)

3.0 OPERATING CONDITIONS

3.1 Material Properties

Material	Dry crushed limestone
Bulk density	1 600 kg/m^3

Size:

Maximum

Size (mm)	Wt. %
-6.00	100
6.00 - 4.75	9.78
4.75 - 3.35	14.50
3.35 - 2.36	17.20
2.36 - 1.70	11.40
1.70 - 1.18	9.10
1.18 - 0.85	6.80
0.85 - 0.25	13.23
-0.25	17.90

Minimum

Size (mm)	Wt. %
-1.0	100
0.3 - 0.1	50
-0.1	0

3.2 Design Data

Design Feed Rate	0.2 kg/s
Storage Bin Pressure	Atmospheric
No. of Bends in Line	4 @ 90°
Total Line Length	20,000 mm
Total Vertical Lift	9 650 mm
Length of Flexible Hose Required	5 000 mm
Diameter of Flexible Hose	50 mm
Rotary Airlock size	150 mm diameter (or as required)
Operating Duty	2,000 hrs annually, indoors

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- pick-up lance and flexible hose (steel conveying pipe not included)
- separator inlet transition connection
- separator air outlet (vacuum) transition connection

- rotary airlock discharge flange
- inlet and outlet connections of filter unit if filter is not integral with separator
- blower inlet (vacuum) connection
- blower discharge silencer connection
- electrical terminal boxes on blower and rotary airlock

5.0 TECHNICAL REQUIREMENTS

5.1 Maximum noise level shall be 85 dBA at 1 m.

5.2 The filter and separator shall fit within the clearance allowance of 1.85 m above the storage bin.

6.0 ELECTRIC MOTORS

Electrical power will be supplied at 575 V, 3-phase.

The motor shall be totally enclosed. Its temperature rise shall not be greater than for class B insulation. It shall be equipped with a removable drain plug.

7.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

8.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

Air Moving and Conditioning Association	AMCA
American Conference of Government Industrial Hygienists	ACGIH
Canadian Standards Association	CSA
Conveyor Equipment Manufacturers Association	CEMA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturer's Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

9.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

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10.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

11.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

PNEUMATIC CONVEYING SYSTEM

1.	One (1) pneumatic conveying system as described in the specification, FOB point of sale	$ ________
2.	Canadian Customs Duty (where applicable) _____ % of $ _________	$ ________
3.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

PNEUMATIC CONVEYING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name ______________________________

Vendor's Name ______________________________

Blower Model and Type ______________________________

Filter/Separator Model and Type ______________________________

Rotary Airlock Model and Type ______________________________

Weight of blower package ____________ kg

Weight of separator & rotary airlock ____________ kg

Height of separator & rotary airlock ____________ mm

Rotary airlock flange size ____________ mm

Maximum conveyor capacity ____________ kg/s

Blower motor

- Type ______________________________
- Manufacturer ______________________________
- Output ____________ kW
- Speed ____________ rpm
- Temperature rise ____________ °C
- Frame size ____________

Blower data

- Volumetric flow ____________ m^3/s
- Speed ____________ rpm
- Size of suction connection ____________ mm
- Size of discharge connection ____________ mm

- Vacuum ______ kPa(g)
- Maximum noise level ______ dBA
- Silencer Type ______

Rotary airlock motor

- Enclosure type ______
- Manufacturer ______
- Output ______ kW
- Speed ______ rpm
- Temperature rise ______ °C
- Frame size

Rotary airlock drive

- Type ______
- Manufacturer ______
- Speed ratio ______

2.0 LIST OF ALTERNATIVES AND EXTRAS

______

______

______

______

______

______

______

______

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ______ months

231-1
PORTABLE HOPPERS

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 231-1
ACCOUNT NO. 0243-231

SPECIFICATION FOR PORTABLE HOPPERS

1.0 REQUIREMENT

Tenders are invited for the supply and delivery of three (3) portable hoppers for transporting fuels to the feed system of a pilot scale fluidized bed combustor (FBC).

2.0 SCOPE OF WORK

The Work includes the fabrication, shop testing and delivery of one (1) bucket elevator loading hopper, one (1) fuel bin loading hopper, and one (1) sand loading hopper as shown in drawings 0243 SK 231-1 and 0243 SK 231-2 and as specified herein.

The hoppers shall include, but not be limited to, the following:

- loading nozzle on top of bin
- internal bin coating or lining if required
- manually operated slide gate valve at bin discharge
- lifting eyes for the attachment of wire rope slings and/or crane hooks
- bin support assembly
- standard shop coats of primer and paint.

3.0 OPERATING CONDITIONS

3.1 Materials handled:

Material	Density	Size
Tar sands fluid coke	800 kg/m^3	minus 100 mesh
Coal washery rejects	960 kg/m^3	minus 20 mm
Wood chips	160 kg/m^3	minus 30 mm
Silica sand	1600 kg/m^3	Variable

3.2 Capacity:

Bucket elevator loading hopper	0.73 m^3 (700 kg)
Fuel bin loading hopper	0.46 m^3 (440 kg)
Sand loading hopper	0.16 m^3 (260 kg)

4.0 DESIGN DATA

4.1 The hoppers will be used in a heated building.

4.2 The hoppers will be moved by an overhead crane from floor level for manual filling.

5.0 TECHNICAL REQUIREMENTS

5.1 The hoppers shall be fabricated from mild steel and shall be suitably braced, stiffened and supported on external surfaces only, and shall be designed to resist the live and dead loads to which they may be subjected during normal operation.

5.2 A coating or lining shall be applied to the interior of the hopper, if necessary, to ensure material flow.

5.3 The hoppers shall be furnished with 250 mm diameter plastic pipe caps to cover the top openings. (The sand hopper shall have an open top.)

5.4 Manual slide gate valves shall be installed at the hopper discharge. These valves shall be easily operable when the hopper is full of material.

5.5 Heavy duty casters shall be installed on the hopper support legs and shall permit the hopper to be moved on a concrete floor by one man.

5.6 Heavy duty lifting lugs shall be provided so the hoppers can be moved with an overhead crane. The lugs shall be designed to be slung as shown on the drawings.

6.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

7.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

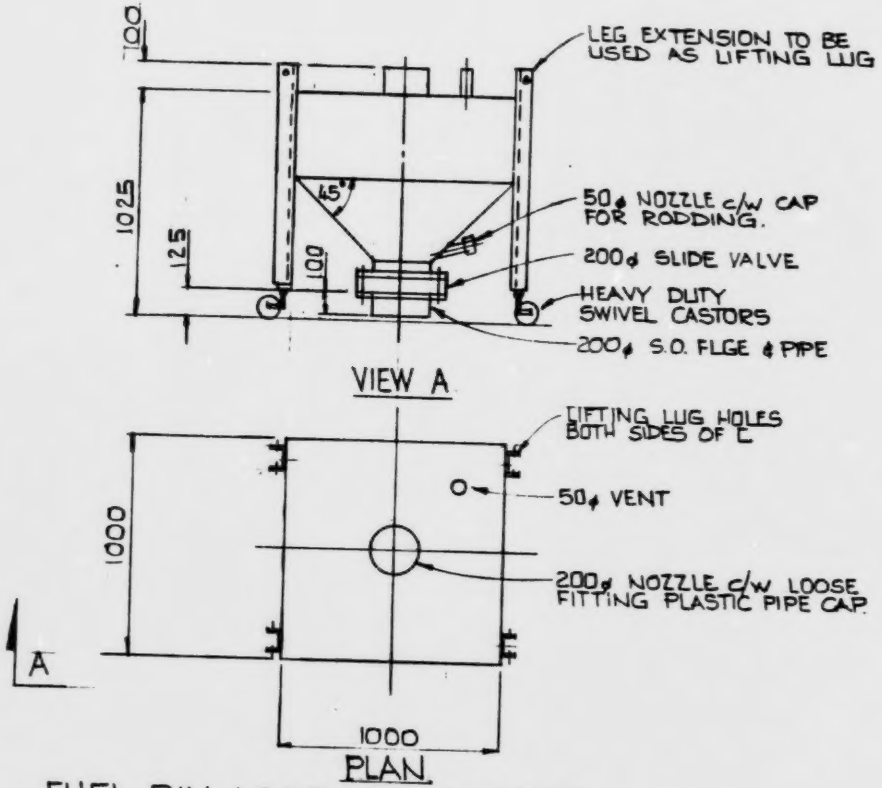
8.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings.

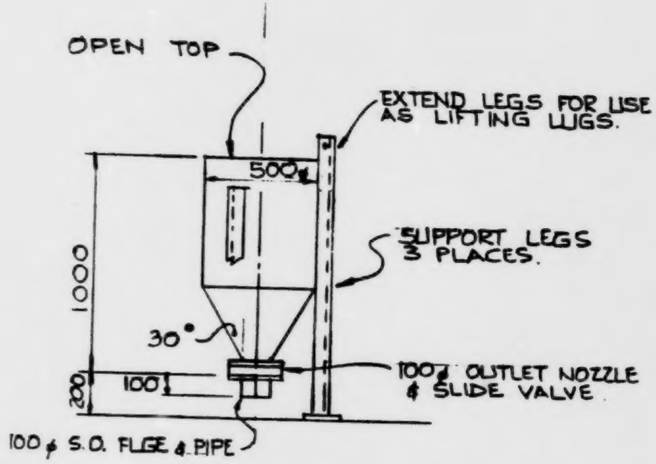
9.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.



100
1025
125
100
45°
LEG EXTENSION TO BE USED AS LIFTING LUG
50φ NOZZLE c/w CAP FOR RODDING.
200φ SLIDE VALVE
HEAVY DUTY SWIVEL CASTORS
200φ S.O. FLGE & PIPE
VIEW A
LIFTING LUG HOLES BOTH SIDES OF ℄
50φ VENT
200φ NOZZLE c/w LOOSE FITTING PLASTIC PIPE CAP.
1000
1000
A
PLAN

FUEL BIN LOADING HOPPER



OPEN TOP
500φ
EXTEND LEGS FOR USE AS LIFTING LUGS.
SUPPORT LEGS 3 PLACES.
1000
30°
200
100
100φ OUTLET NOZZLE & SLIDE VALVE
100φ S.O. FLGE & PIPE

SAND LOADING HOPPER

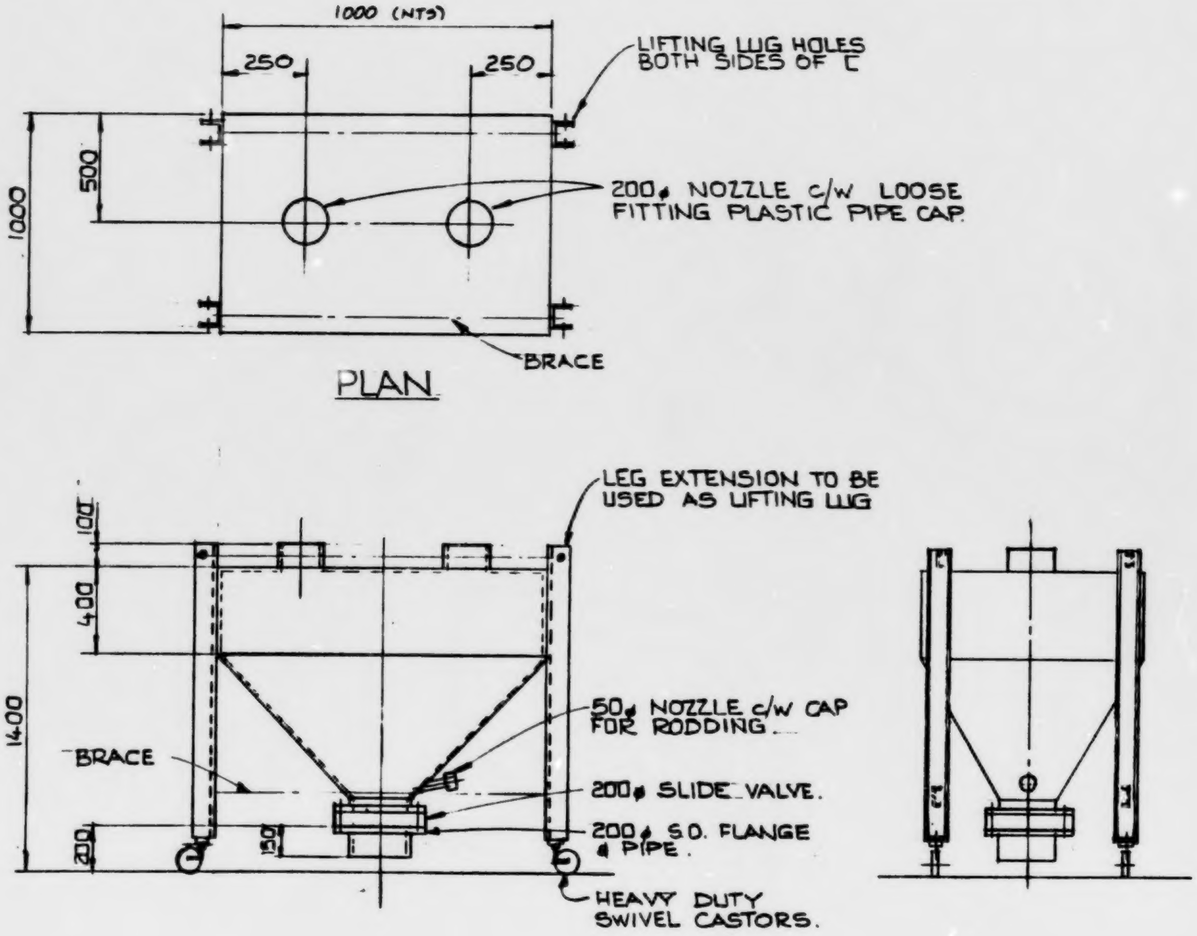
Design	Drawn	Check	Appd	Issued for	Date	Rev
	LR			REVIEW	[illegible]	0

ENERGY MINES & RESOURCES
CANADA

integ
Intercontinental Engineering Ltd

FUEL & SAND LOADING HOPPERS.

B | 0234 | SK | 231-1 | 0


1000 (NTS)
250
250
LIFTING LUG HOLES BOTH SIDES OF ℄
500
1000
200ø NOZZLE c/w LOOSE FITTING PLASTIC PIPE CAP.
BRACE
PLAN
LEG EXTENSION TO BE USED AS LIFTING LUG
100
400
1400
50ø NOZZLE c/w CAP FOR RODDING
BRACE
200ø SLIDE VALVE.
200ø S.O. FLANGE & PIPE.
200
150
HEAVY DUTY SWIVEL CASTORS.

Design	Drawn	Check	Appd	Issued for	Date	Rev

ENERGY MINES & RESOURCES
CANADA

integ
Intercontinental Engineering Ltd

BUCKET ELEVATOR
LOADING HOPPER

B | 0234 | SK | 231-2 | 0

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR LOADING HOPPER

1.	One (1) bucket elevator loading hopper as described in the specification, FOB point of sale	$ ________
2.	Transportation to site	$ ________
	TOTAL	$ ________

FUEL BIN LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ ________
2.	Transportation to site	$ ________
	TOTAL	$ ________

SAND LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ ________
2.	Transportation to site	$ ________
	TOTAL	$ ________

SCHEDULE II - TECHNICAL DATA

PORTABLE HOPPERS

1.0 SPECIFICATIONS

Bucket Elevator Loading Hopper

Manufacturer's name ____________________

Vendors name ____________________

Hopper outside dimensions ____________ mm

Total weight ____________ kg

Maximum capacity ____________ m^3

Wall material ____________________

Wall thickness ____________ mm

Fuel Bin Loading Hopper

Manufacturer's name ____________________

Vendors name ____________________

Hopper outside dimensions ____________ mm

Total weight ____________ kg

Maximum capacity ____________ m^3

Wall material ____________________

Wall thickness ____________ mm

Sand Loading Hopper

Manufacturer's name ____________________

Vendors name ____________________

Hopper outside dimensions ____________ mm

Total weight ____________ kg

Maximum capacity ____________ m^3

Wall material ______________________________

Wall thickness ____________ mm

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____________ months

241-1

FUEL TRANSFER SCREW NO. 1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 241-1
ACCOUNT NO. 0243-241

SPECIFICATION FOR FUEL TRANSFER SCREW NO. 1

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) fuel transfer conveyor for supplying fuel and sorbent to a pilot scale, fluidized bed combustor.

2.0 SCOPE OF WORK

The Work shall include the fabrication, shop testing, and delivery of one (1) variable speed screw conveyor as shown on drawing 0243 SK 241-1, included with this specification.

The Vendor shall supply the conveyor as specified herein which shall include, but not be limited to, the following:

- full pitch screw conveyor
- formed, flanged, U-shaped trough
- trough cover complete with gaskets and bolts
- end plates
- three (3) flanged inlet spouts
- one (1) flanged discharge spout
- drive and tail shafts
- bearings
- shaft seals
- remotely controlled variable speed drive
- electric drive motor with belts and drive guard
- air purge connection
- any special tools required for installation and/or maintenance
- shop coats of primer and paint.

3.0 OPERATING CONDITIONS

3.1 Fuel Properties

Material	Tar sands fluid coke	Coal washery rejects
Total Moisture (%)	3.6	20.1
Max. Surface Moisture (%)	-	7.0
Bulk Density (kg/m^3)	800	960

Size Distribution (%):

19mm/13mm	-	3.04
13mm/6mm	-	20.20
6mm/3mm	-	28.34
3mm/16 mesh	-	16.90
16 mesh/ 28 mesh	-	9.52
28 mesh/ 100 mesh	-	22.00
100 mesh/0	100	-

3.2 Sorbent Properties

Material	Dry crushed limestone
Bulk density	1 600 kg/m^3

Size:

Maximum

Size (mm)	Wt. %
-6.00	100
6.00 - 4.75	9.78
4.75 - 3.35	14.50
3.35 - 2.36	17.20
2.36 - 1.70	11.40
1.70 - 1.18	9.10
1.18 - 0.85	6.80
0.85 - 0.25	13.23
-0.25	17.90

Minimum

Size (mm)	Wt. %
-1.0	100
0.3 - 0.1	50
-0.1	0

3.2 Design Data

Material	Reject Coal	Coke/Limestone
Bulk Density (kg/m^3)	960	800/1600
Design Flow (kg/s)	0.095	0.026/0.014
Minimum Flow (kg/s)	0.019	0.005/0.003

Maximum Temperature at Discharge of Screw	93°C
Purge Air Pressure	100 kPag
Conveyor Pressurization	34 kPag
Operating Duty	2 000 hrs/year

Inlet Connection Sizes:	
Fuel	To Be Advised Later
Limestone	To Be Advised Later
Sand	To Be Advised Later
Outlet Connection Size	150 mm Dia.

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- conveyor inlet flanges
- discharge spout flange
- air purge connection
- electrical terminal box on drive
- remote control drive module

5.0 DESIGN CONDITIONS

5.1 The screw conveyor will feed fuel and sorbent to a slightly pressurized fluidized bed combustor. Combustor operating pressure can vary from 21 to 52 kPag, however a rotary valve will be installed downstream of the feeder to provide a partial seal. Combustor operating temperature can reach 1100°C, but this should be reduced to 93°C at the screw.

5.2 The screw will be uniformly fed by two weighfeeders, metering fuel and sorbent, and occasionally by a manual hopper, dispensing sand.

5.3 The weighfeeders will be pressurized to 34 kPag.

5.4 The screw will be located inside a heated building.

6.0 TECHNICAL REQUIREMENTS

6.1 The screw conveyor will be airtight, and pressurized to 34 kPag by air supplied at approximately 100 kPag.

6.2 The screw will be supported as indicated on sketch 0243 SK 241-1.

6.3 A remote control variable speed drive shall be provided to maintain appropriate manually selected screw speeds. The speed range shall be appropriate to maintain the screw at least 30% full throughout the range of material flowrates.

7.0 VARIABLE SPEED DRIVES

7.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

7.2 Motors shall be totally enclosed and approved for Class II, Division 1, Group F hazardous locations as defined by the Canadian Electrical Code.

7.3 Motors with permanent magnet fields shall be supplied where feasible.

7.4 The drive controller shall be contained in an EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

7.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

7.6 The following accessories shall be provided:

a) Pickup for speed indicator
b) Auxiliary contacts for interlock
c) Thermal overload relay for motor protection, with contact for remote alarm.

7.7 The following operators controls shall be provided:

a) Speed adjusting potentiometer
b) Start-stop switch
c) Run-jog selector switch
d) Speed indicator, 2% accuracy.

7.8 Electrical power will be supplied at 575 V 3-phase and 115 V and 230 V 1-phase.

8.0 ALTERNATIVES AND EXTRAS

The Bidder is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

As a separately priced optional extra the bidder is encouraged to include a variable speed rotary airlock valve (generally as specified in Inquiry No. 241-2), to be installed at the discharge of the screw conveyor. The valve speed would be controlled from the screw remote control module by a master/slave arrangement.

9.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

Canadian Standards Association	CSA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC
National Electrical Manufacturers Association	NEMA

Use of other standards in place of those listed above shall be clearly stated in the bid.

10.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

11.0 DRAWINGS AND MANUALS

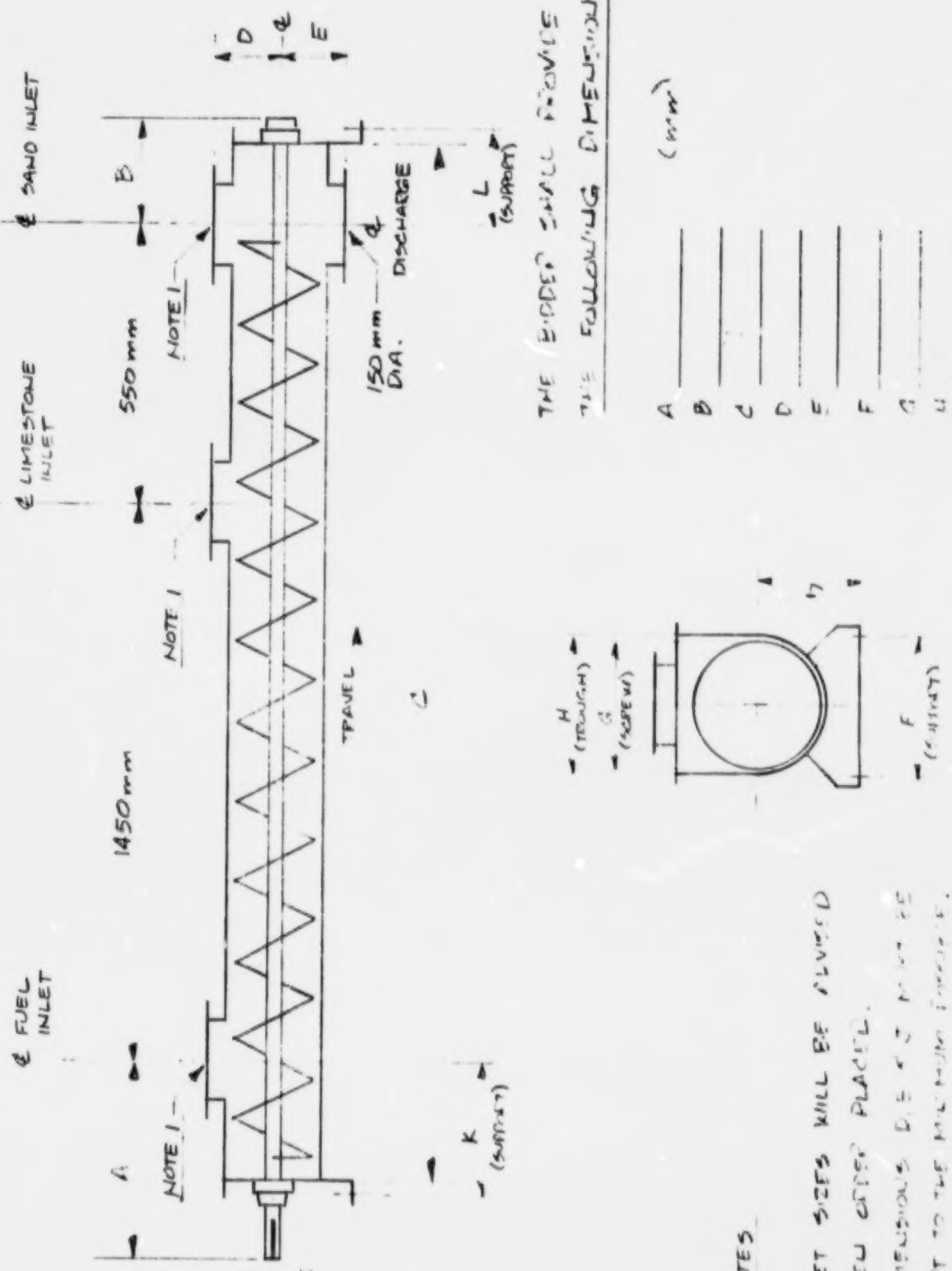
The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be furnished with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

12.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and requested dimensions filled in on sketch 0243 SK 241-1, and all the foregoing returned with the tender.



SAND INLET
B
D
E
LIMESTONE INLET
550 mm
NOTE 1
150 mm DIA.
DISCHARGE
L (SUPPORT)
NOTE 1
TRAVEL
C
1450 mm
FUEL INLET
A
NOTE 1
K (SUPPORT)
DRIVE END
H (TROUGH)
G (SCREW)
F (SUPPORT)
J

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS (mm)

A ________
B ________
C ________
D ________
E ________
F ________
G ________
H ________
J ________
K ________
L ________

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.
2. DIMENSIONS D, E, F, G MAY BE LEFT TO THE MANUFACTURER'S DISCRETION.

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE	NTS	DATE	FUEL TRANSFER SCREW NO. 1 ARRANGEMENT
DRAWN		83-04-14	
CHECK			
APP'D.			A 0243 [illegible] 241-1

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.1

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ ___________
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ ___________
3.	Transportation to site	$ ___________
	TOTAL	$ ___________

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.1

1.0 SPECIFICATIONS

Manufacturer's Name ______________________

Vendor's Name ______________________

Model and Type ______________________

Conveyor outside dimensions __________ mm

Conveyor weight (c/w drive) __________ kg

Screw diameter __________ mm

Flight material ______________________

Flight thickness __________ mm

Shaft diameter __________ mm

Shaft material ______________________

Type of bearings ______________________

Trough material ______________________

Trough material thickness ______________________

Variable speed drive

- Type ______________________
- Manufacturer ______________________
- Model ______________________
- Speed ratio __________

Power supply requirements ______ VA _____ V ____ phase

Motor Data

- Enclosure type ____________________
- Manufacturer ____________________
- Output __________ kW
- Speed __________ rpm
- Temperature rise __________
- Frame size __________

Unit output max. __________ kg/s

2.0 LIST OF ALTERNATIVES AND EXTRAS

____

____

____

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order __________ months

241-2
ROTARY AIRLOCK VALVE

241-2

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 241-2
ACCOUNT NO. 0243-241

SPECIFICATION FOR FEED SYSTEM ROTARY AIRLOCK VALVE

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) rotary airlock valve for the fuel and sorbent feed system of a pilot scale fluid bed combustor.

2.0 SCOPE OF WORK

The Work includes the fabrication, shop testing and delivery of one (1) variable speed rotary airlock valve as specified herein which shall include, but not be limited to, the following:

- drop-through rotary airlock valve
- full pocket, shrouded rotor
- rotor and valve body fabricated with abrasion resistant materials
- round, flanged inlet and discharge
- outboard bearings
- variable speed drive including motor, reducer, drive chains, guards and base plates.

3.0 DESIGN CONDITIONS

3.1 Material Properties

	Fluid Coke	Coal Rejects	Limestone
Moisture (pct)	3.6	20.1	10
Density (kg/m^3)	800	960	1600
Size Dist. (pct)			
50 mm/36 mm	-	-	-
36 mm/25 mm	-	-	-
25 mm/19 mm	-	-	-
19 mm/13 mm	-	3.04	-
13 mm/ 6 mm	-	20.20	-
6 mm/ 3 mm	-	28.34	100 pct
3 mm/16 mesh	-	16.90	Under
16 mesh/28 mesh	-	9.52	6 mm
28 mesh/100 mesh	-	22.00	
100 mesh/0	100	-	

3.2 Design Data

Material	Reject Coal	Coke/Limestone
Bulk Density (kg/m^3)	960	800/1600
Design Flow (kg/s)	0.095	0.026/0.014
Minimum Flow (kg/s)	0.019	0.005/0.003

Differential pressure	35 kPag max.
Inlet and discharge size	100 mm dia.
Operating Duty	2 000 hrs/year

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- inlet flange
- discharge flange
- drive electrical terminal box
- speed indicator

5.0 OPERATING CONDITIONS

5.1 The airlock shall be located after a pressurized variable speed screw feeder, and shall discharge into a 100 mm diameter steel pipe chute to the combustor. The chute shall be about 1000 mm long, inclined downward at 60°, and shall be purged with cool air to reduce the backflow of hot combustion gases.

5.2 The combustor casing temperature will be no more than 100°C, however the internal chute temperature could reach 800°C upon failure of the purge air supply. Normal temperature is expected to be 200 - 400°C.

5.3 The rotary airlock will provide a gas seal between a screw conveyor and the feed chute of the combustor.

5.4 Under normal operating conditions, the airlock discharge will be at a lower pressure than the inlet.

6.0 TECHNICAL REQUIREMENTS

6.1 The airlock shall provide a seal against the backflow of combustion gases in the event the feed system air purge should fail.

6.2 The airlock shall be designed for continuous service with fine, abrasive materials, as specified in Section 3.

6.3 A manually controlled variable speed drive shall be provided.

6.4 Pricing and alternate specifications shall be provided for a valve capable of operating at up to 70 kPag differential pressure.

7.0 VARIABLE SPEED DRIVES

7.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

7.2 Motors shall be totally enclosed and approved for Class II, Division 1, Group F hazardous locations as defined by the Canadian Electrical Code.

7.3 Motors with permanent magnet fields shall be supplied where feasible.

7.4 The drive controller shall be contained in an EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

7.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

7.6 The following accessories shall be provided:

a) Pickup for speed indicator
b) Auxiliary contacts for interlock

7.7 The following operators controls shall be provided:

a) Speed adjusting potentiometer
b) Start-stop switch
c) Speed indicator, 2% accuracy.

7.8 Electrical power shall be supplied at 115 V and 230 V 1-phase.

8.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

9.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

Canadian Standards Association	CSA
Conveyor Equipment Manufacturers Association	CEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

10.0 WARRANTY

The Vendor shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

11.0 DRAWINGS AND MANUALS

The Bidder shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and wiring diagram shall also be included with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

12.0 INFORMATION REQUIRED WITH TENDER

In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.

SCHEDULE I - SCHEDULE OF PRICES

FEED SYSTEM ROTARY AIRLOCK VALVE

1.	One (1) rotary airlock valve as described in the specification, FOB point of sale	$ ____________
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ ____________
3.	Transportation to site	$ ____________
	TOTAL	$ ____________

SCHEDULE II - TECHNICAL DATA

FEED SYSTEM ROTARY VALVE

1. SPECIFICATIONS

Manufacturer's name ____________

Vendor's name ____________

Airlock model and type ____________

Airlock weight ____________ kg

Airlock outside dimensions ____________ mm

Flange size ____________ mm

Capacity - minimum ____ m^3/rev @ ____ rpm
maximum ____ m^3/rev @ ____ rpm

Airlock motor -

Enclosure type ____________

Manufacturer ____________

Power output ____________ kW

Speed ____________ rpm

Frame size ____________

Temperature rise ____________ °C

Airlock drive -

Type ____________

Manufacturer ____________

Speed Ratio ____________

Power supply requirements ______ VA _____ V ____ phase

2. LIST OF ALTERNATIVES AND EXTRAS

3. DELIVERY

Time required for manufacture and shipment from receipt of order ________________ months

242-1

FUEL TRANSFER SCREW NO. 2

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 242-1
ACCOUNT NO. 0243-242

SPECIFICATION FOR FUEL TRANSFER SCREW NO. 2

1.0 REQUIREMENT

Tenders are invited for the supply of one (1) fuel transfer conveyor for supplying fuel and sorbent to a pilot scale, fluidized bed combustor (FBC).

2.0 SCOPE OF WORK

The Work shall include the fabrication, shop testing and delivery of one (1) variable speed screw conveyor as shown on drawing 0243 SK 242-1, included with this specification.

The Vendor shall supply the conveyor as specified herein which shall include, but not be limited to, the following:

- screw conveyor, inclined 0 degrees, full pitch for 2/3 of length changing to half pitch at discharge end
- discharge end (half pitch section) to have 310 S.S. shaft and flights
- tubular trough with water jacketed discharge section
- ANSI B16.5 150 lb. flange connection
- two (2) flanged inlet spouts
- drive shaft and shaft seal
- bearing
- remotely controlled variable speed drive
- remote control module
- air purge connection
- mounting flange gasket
- any special tools required for installation and/or maintenance
- shop coats of primer and paint.

3.0 OPERATING CONDITIONS

3.1 Fuel Properties (Coke and Coal Rejects)

Material	Tar sands fluid coke	Coal washery rejects
Total Moisture (%)	3.6	20.1
Max. Surface Moisture (%)	-	7
Bulk Density (kg/m^3)	800	960

Size Distribution (%):

19mm/13mm	-	3.04
13mm/6mm	-	20.20
6mm/3mm	-	28.34
3mm/16 mesh	-	16.90
16 mesh/ 28 mesh	-	9.52
28 mesh/ 100 mesh	-	22.00
100 mesh/0	100	-

3.2 Wood Fuel Properties

Material	Wood chips
Moisture (%)	30 - 60
Bulk Density (kg/m^3)	160

Size Distribution:

Screen Size (mm)	% retained
50	0
30	10.64
25	15.97
15	34.74
10	30.71
5	5.88
Fines	2.06
Bark	9.45

3.3 Sorbent Properties

Material	Dry crushed limestone
Bulk density	1 600 kg/m^3

Size:

Maximum

Size (mm)	Wt. %
-6.00	100
6.00 - 4.75	9.78
4.75 - 3.35	14.50
3.35 - 2.36	17.20
2.36 - 1.70	11.40
1.70 - 1.18	9.10
1.18 - 0.85	6.80
0.85 - 0.25	13.23
-0.25	17.90

	Minimum	
	Size (mm)	Wt. %
	-1.0	100
	0.3 - 0.1	50
	-0.1	0

3.4 Design Data

Material	Reject Coal	Coke/ Limestone	Wood
Bulk Density (kg/m^3)	960	800/1600	160
Design Flow (kg/s)	0.095	0.026/0.014	0.025
Minimum Flow (kg/s)	0.019	0.005/0.003	0.005

Maximum Temperature at Discharge	1100°C
Pressure at Discharge:	
Maximum	52 kPag
Normal	21 kPag
Purge Air Pressure	100 kPag
Operating Duty	2 000 hrs/year
Cooling Water Temperature	29°C

4.0 TERMINAL POINTS

The terminal points of this specification shall include:

- conveyor inlet flanges
- conveyor discharge
- water jacket inlet and outlet connections
- electrical terminal box on drive
- air purge connection
- remote control module
- mounting flange and gasket.

5.0 DESIGN DATA

5.1 The conveyor will feed fuel (coke, reject coal, or wood and sorbent (limestone - with coke only)) to a slightly pressurized fluidized bed combustor. Combustor operating pressure can vary from 21 to 52 kPag, and the temperature can reach 1100°C.

5.2 The screw will be mounted to the wall of the combustor (as shown on sketch 0243 SK 242-1) and sealed against gas leakage at the mounting flange. Conveyor support will be from below as shown on the sketch.

5.3 The screw will be used infrequently and will be removed from the combustor when not in use.

5.4 Fuel and sorbent weighfeeders will be pressurized to 34 kPag.

6.0 TECHNICAL REQUIREMENTS

6.1 The screw conveyor will be airtight and pressurized to 34 kPag by air supplied at 100 kPag.

6.2 A remote control variable speed drive shall be provided to maintain appropriate manually selected screw speeds. The speed range shall be appropriate to maintain the screw at 95% full throughout the range of material flowrates (for wood - this may be less in the case of coal feed).

6.3 The discharge end of the tubular trough shall be surrounded by a cooling water jacket to protect the screw and trough and to prevent fuel from burning in the conveyor. Cooling water shall be provided at 29°C.

6.4 The discharge end of the screw shall have flights and shaft fabricated from type 310 stainless steel in order further protect against combustor temperatures.

6.5 The screw pitch shall be reduced from full pitch to half pitch for the last third of the screw length toward the discharge.

6.6 Consideration will also be given to an alternative variable pitch screw to affect a better seal against backflow.

6.7 The screw and the jacket outside diameter shall be the minimum possible size, consistent with operating and performance requirements, in order to minimize the size of the combustor opening.

6.8 The bidder will advise the required size of the combustor mounting flange and will include for a flange gasket in the price.

7.0 VARIABLE SPEED DRIVES

7.1 Variable speed drives shall consist of dc electric motors with static control circuitry for varying motor speed by varying armature supply voltage. Specified drives shall be ImPak Plus or MinPak Plus, manufactured by Reliance Electric, or approved equal.

7.2 Motors shall be totally enclosed and approved for Class II, Division 1, Group F hazardous locations as defined by the Canadian Electrical Code.

7.3 Motors with permanent magnet fields shall be supplied where feasible.

7.4 The drive controller shall be contained in on EEMAC 1 general purpose enclosure for installation in the Owner's air conditioned control room.

7.5 Operator controls shall be fixed on a plate suitable for mounting on the face of a control panel in the Owner's control room.

7.6 The following accessories shall be provided:

- a) Pickup for speed indicator
- b) Auxiliary contacts for interlock
- c) Thermal overload relay for motor protection, with contact for remote alarm.

7.7 The following operators controls shall be provided:

- a) Speed adjusting potentiometer
- b) Start-stop switch
- c) Run-jog selector switch
- d) Speed indicator, 2% accuracy.

7.8 Electrical power shall be provided at 115 V and 230 V 1-phase.

8.0 ALTERNATIVES AND EXTRAS

The Vendor is requested to clearly describe and separately price any alternatives or extra components he may feel appropriate for reliability or performance considerations.

The Vendor is requested to comment on the feasibility of using a variable pitch screw as specified to reduce the backflow of combustion gases from the FBC.

9.0 STANDARDS AND CODES

All equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and of the latest edition of the following codes:

American Society of Mechanical Engineers	ASME
American Society of Testing and Materials	ASTM
American National Standards Institute	ANSI
Canadian Standards Association	CSA
Conveyor Equipment Manufacturers Association	CEMA
Electrical and Electronic Manufacturers' Association of Canada	EEMAC

Use of other standards in place of those listed above shall be clearly stated in the bid.

10.0 WARRANTY

The Bidder shall warrant that all workmanship, materials and equipment (to the extent supplied by the Vendor only) incorporated into the work shall comply in all respects with contract documents and shall be free from defects (including latent defects); the Vendor shall correct, at the Vendor's expense, any defects in the work (including latent defects) due to faulty materials or equipment supplied by the Vendor or the Vendor's workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the Purchaser, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

11.0 DRAWINGS AND MANUALS

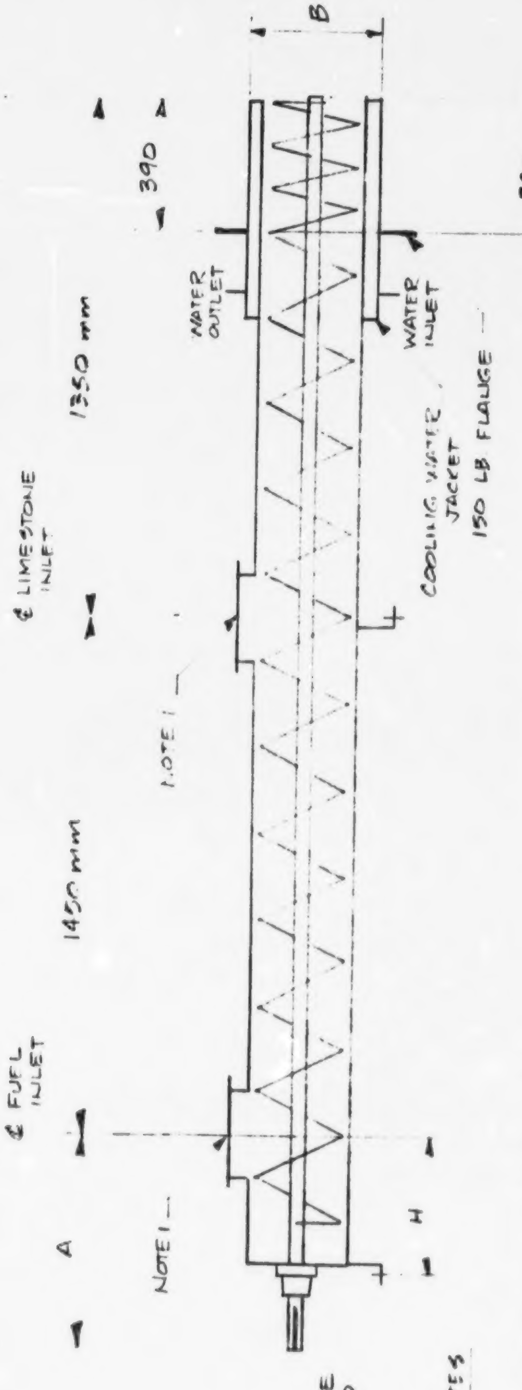
The Vendor shall submit with his bid an arrangement drawing of the equipment including all accessories supplied. The drawing shall illustrate all critical sizes and dimensions and all pertinent data of the equipment. All electrical, instrumentation, piping and support connections should be clearly indicated. A control schematic and a wiring diagram shall also be included with the bid.

Prior to shipment, the successful Bidder shall submit one (1) reproducible and three (3) copies of all required drawings including arrangement, layout, control schematics, wiring diagrams, performance curves and specification sheets. All of these drawings and specifications shall be certified.

The successful Bidder shall also supply six (6) copies of maintenance and operating manuals.

12.0 INFORMATION REQUIRED WITH TENDER

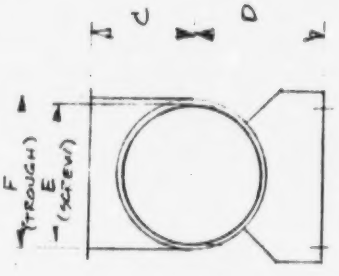
In addition to the information requested herein, the attached Schedules shall be completed and returned with the tender.


B
390
390
1350 mm
1450 mm
WATER OUTLET
WATER INLET
COOLING WATER JACKET
150 LB FLANGE
℄ LIMESTONE INLET
℄ FUEL INLET
NOTE 1
NOTE 1
A
H
DRIVE END

SCREW AND SHAFT IN
THIS SECTION FABRICATED
IN 310 STAINLESS STEEL

THE BIDDER SHALL PROVIDE
THE FOLLOWING DIMENSIONS:

A ________ mm
B ________
C ________
D ________
E ________
F ________
G ________ mm
H ________
COMBUSTOR FLANGE ________


C
D
F (TROUGH)
E (SCREW)
G (SUPPORT)

NOTES

1. INLET SIZES WILL BE ADVISED
WHEN ORDER PLACED

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

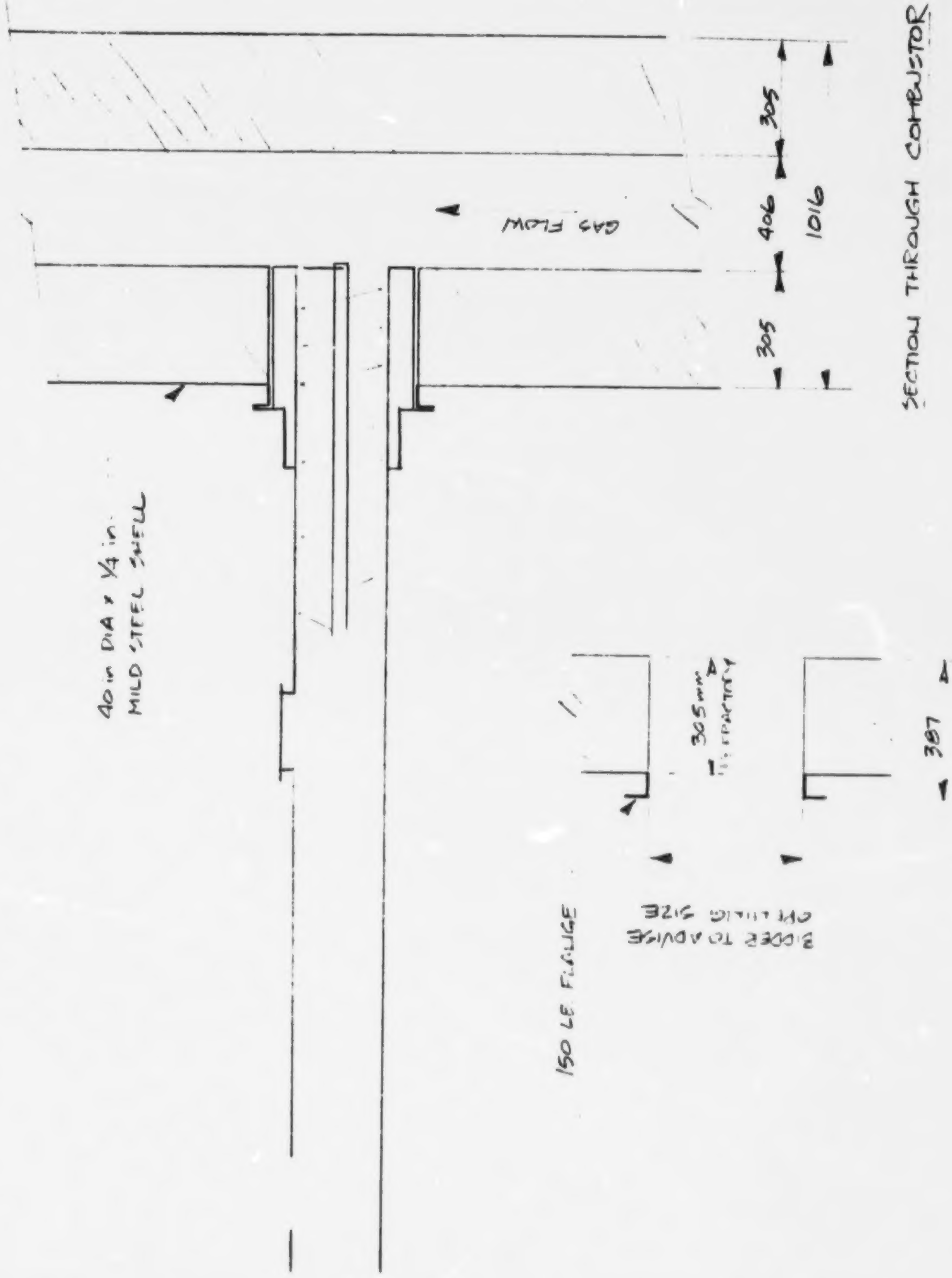
integ
Intercontinental Engineering Ltd

SCALE	NTS	DATE
DRAWN		83-09-14
CHECK		
APP'D.		

FUEL TRANSFER SCREW NO. 2
ARRANGEMENT

SHEET 1

A	0243	SL	242-1


SECTION THROUGH COMBUSTOR
305
406
1016
305
GAS FLOW
40 in DIA x 1/4 in MILD STEEL SHELL
305 mm REFRACTORY
387
150 LB FLANGE
BIDDER TO ADVISE OPENING SIZE
SECTION OF COMBUSTOR PENETRATION

ENERGY, MINES AND RESOURCES CANADA			**ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR RESEARCH FACILITY**
Intercontinental Engineering Ltd	SCALE NTS	DATE	FUEL TRANSFER SCREW NO. 2 INSTALLATION DETAILS SHEET 2
	DRAWN	83-09-14	
	CHECK		
	APP'D.		A | 0243 | SK | 242-1

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.2

1. One (1) screw conveyor system as described in the specification, FOB point of sale $ ___________

2. Canadian Customs Duty (where applicable) _____ % of $ __________ $ ___________

3. Transportation to site $ ___________

TOTAL $ ___________

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.2

1.0 SPECIFICATIONS

Manufacturer's Name ________________________

Vendor's Name ________________________

Model and Type ________________________

Conveyor outside dimensions ____________ mm

Conveyor weight (c/w drive) ____________ kg

Screw diameter ____________ mm

Screw pitch ____________ mm

Flight material ________________________

Flight thickness ____________ mm

Shaft diameter ____________ mm

Shaft material ________________________

Type of bearings ________________________

Trough material ________________________

Trough material thickness ________________________

Variable speed drive

- Type ________________________
- Manufacturer ________________________
- Model ________________________
- Speed ratio ____________

Power supply requirements ______ VA _____ V ____ phase

Motor Data

- Enclosure type ______________
- Manufacturer ______________
- Output ______________ kW
- Speed ______________ rpm
- Temperature rise ______________ °C
- Frame size ______________

Unit output max. ______________ kg/s

Water requirements @ design conditions ______________ kg/s

Water jacket dimensions ______________ mm

Size of combustor mounting flange ______________ mm

2.0 LIST OF ALTERNATIVES AND EXTRAS

____

____

____

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ______________ months

251-1

MATERIALS HANDLING GATES

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 251-1
ACCOUNT NO. 0243-251

SPECIFICATION FOR MATERIALS HANDLING GATES

1.0 SCHEDULE

ITEM	DESCRIPTION	SERVICE
G1	No. 1 Screw Conveyor sand inlet	Sand
G2	No. 1 Screw Conveyor airlock outlet	Coal, etc.
G3	No. 2 Screw Conveyor, sand inlet on limestone chute	Sand
G4	Combustor drain outlet	Hot ash
G5	Flue gas cooler ash outlet	Warm flyash

2.0 OPERATING CONDITIONS

ITEM	NOMINAL SIZE (mm dia.)	TEMPERATURE (°C)	PRESSURE (kPa(g))	NORMAL POSITION
G1	100	260	20	Closed
G2	100	260	20	Open
G3	100	260	35	Closed
G4	75	1,000	45	Open
G5	100	260	-2	Closed

3.0 TECHNICAL REQUIREMENTS

3.1 Sealing is important for G3 and G4 due to the presence of hot combustor gases.

3.2 G4 may normally be insulated by a static layer of ash.

3.3 Standard 150 lb. bolting flanges shall be provided.

252-1
FLUE GAS DAMPERS

252-1

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 252-1
ACCOUNT NO. 0243-252

SPECIFICATION FOR FLUEGAS DAMPERS

1.0 SCHEDULE

ITEM	DESCRIPTION	REMARKS
D1	Flue gas cooler bypass	Normally closed
D2	Flue gas cooler inlet	
D3	Baghouse bypass inlet	Horizontal, normally closed
D4	Baghouse inlet	
D5	Baghouse outlet	Horizontal
D6	Baghouse bypass outlet	Normally closed

2.0 OPERATING CONDITIONS

ITEM	NOMINAL SIZE (mm dia.)	TEMPERATURE (°C)	PRESSURE (kPa(g))	GAS FLOW (Am^3/s)
D1	200	1,100	2	0.90
D2	300	1,100	2	1.80
D3	200	260	2	0.35
D4	200	260	6	0.70
D5	250	260	6	0.70
D6	200	260	6	0.35

3.0 TECHNICAL REQUIREMENTS

3.1 Dampers are for isolation only and shall seal with maximum leakage of 2 percent of rated airflow at rated temperature and pressure.

3.2 Standard 150 lb. bolting flanges shall be provided.

3.3 All dampers shall be oriented vertically, except D3 and D5, which shall be horizontal.

3.4 Dampers shall be actuated by manual chainwheels - 4 m of chain shall be provided.

3.5 Damper position shall be indicated.

253-1

EXPANSION JOINTS

PROJECT 0243
ENERGY, MINES AND RESOURCES CANADA
ARFBC RESEARCH FACILITY

DATE:
INQUIRY NO. 253-1
ACCOUNT NO. 0243-253

SPECIFICATION FOR EXPANSION JOINTS

1.0 SCHEDULE

ITEM	DESCRIPTION	ORIENTATION
J1	Screw Conveyor No. 1 discharge	Vertical
J2	Screw Conveyor No. 2 fuel chute	Vertical
J3	Screw Conveyor No. 2 sorbent chute	45 degrees
J4	Bed drain cooler inlet	Vertical
J5	Fluegas cooler inlet	Horizontal
J6	Fluegas cooler outlet	Horizontal
J7	Fluegas cooler bypass	Horizontal
J8	Flyash recycle inlet	60 degrees

2.0 OPERATING CONDITIONS

ITEM	NOM. SIZE (mm dia.)	TEMPERATURE (°C)	PRESSURE (kPa(g))	DEFLECTION (mm)	
				AXIAL	TANGENTIAL
J1	100	260	35	12.4	3.6
J2	200	260	35	2.8	7.4
J3	150	260	35	2.8	2.8
J4	75	1,000	35	5.1	0
J5	300	1,100	-0.4	13.7	2.0
J6	200	260	-5.4	6.1	3.0
J7	200	260	-0.5	2.0	3.0
J8	50	1,000	35	5.1	0

3.0 TECHNICAL REQUIREMENTS

3.1 Internal liners shall be provided.

3.2 Standard 150 lb. bolting flanges shall be provided.

3.3 All joints shall be free fluxing.

Volume

3

ENERGY, MINES AND RESOURCES. CANADA
CANMET / CCRL

DESIGN OF AN ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTION RESEARCH FACILITY

Work on this project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources, Canada.

DSS FILE NUMBER : 15SQ.23440-2-9141
DSS CONTRACT SERIAL NUMBER : OSQ82-00224
CANMET SCIENTIFIC AUTHORITY : D. Desai

VOLUME III

APPENDIX VI – BIDDERS' LISTS AND SUPPLIERS EQUIPMENT PROPOSALS

397 pp

JULY 1984

FEB [illegible] 1985
MICROMEDIA

GA Technologies

integ
Intercontinental Engineering Ltd

integ
Intercontinental Engineering Ltd.

14 September 1984
File: 0243-K1

Mr. D. Desai
Combustion & Carbonization
Research Laboratory
CANMET, Energy Research Labs.
Dept. of Energy, Mines & Resources
555 Booth St.
Ottawa, Ontario
K1A 0G1

Dear Sir:

Re: Final Report
ARFBC Research Facility Design
Contract Serial No. OSQ82-00224
DSS File No. 15SQ.23440-2-9141

We are pleased to submit herewith five (5) copies of our final report for the above contract. The report was prepared by INTEG-Intercontinental Engineering Ltd. and GA Technologies in accordance with the scope of work set out in Contract OSQ82-00224 and Amendments dated August 15, 1983 and March 1, 1984.

A draft report was presented in August, 1984 and most of the material has also been issued as milestone reports.

The report comprises four volumes, identified as follows:

Volume I - Design Report
Volume II - Equipment Specifications
Volume III - Bidders lists and Equipment Suppliers Quotations
Volume IV - Drawings

All drawings produced for this contract are included in Volume IV in reduced form for convenient reference, and the major drawings are included as well in Appendix II of Volume I for added convenience.

The design report includes a section which details the further work required to complete the procurement and final engineering of the facility. A recommended staged purchasing program is described which will facilitate the final engineering and minimize procurement delays.

.../2

1155 West Pender St., Vancouver, B.C., Canada V6E 2P4 / Tel. (604) 682-7841 / Telex. 04-51296 / Cables. Vaninteg Vancouver

This report describes the second phase of the design of the ARFBC research facility. The first phase, prepared by others, was a conceptual design study. This phase encompasses the first part of the detailed engineering and includes development of the design to the tender stage and preparation of a detailed cost estimate. The information and drawings contained in this report are all subject to revision following procurement and receipt of certified equipment drawings and specifications.

We trust you will find the contents of the report to your satisfaction and will be pleased to offer any further assistance on this project.

Yours very truly,

INTEG-Intercontinental Engineering Ltd.

G.R. Cooper, P.Eng.
Project Manager

GRC/mt
c.c. E. Fresque D.S.S.

DESIGN REPORT

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DESIGN REPORT

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VOLUME IV

DRAWINGS

0243-0034

VOLUME III

APPENDIX VI

BIDDERS' LISTS AND EQUIPMENT SUPPLIERS' QUOTATIONS

MAJOR EQUIPMENT LIST

111-1	Atmospheric Recirculating Fluidized Bed Combustor
121-1	Forced Draft Blower
131-1	Ignition Burner
141-1	Bed Drain Cooler
151-1	Combustor Bayonet Tubes
152-1	Flue Gas Cooler
153-1	Water Cooling System - Heat Exchanger - Cooling Tower
153-2	Cooling Water Pumps - Circulating Pump - Cooling Tower Pump
153-3	Cooling Tower Sump
161-1	Baghouse
161-2	Flyash Recycle Rotary Valve
162-1	Flyash Recycle System
171-1	Induced Fan
173-1	Stack
211-1	Fuel Storage and Metering System
212-1	Bucket Elevator
221-1	Limestone Storage and Metering System
222-1	Pneumatic Conveying System
231-1	Portable Hoppers - Bucket Elevator Loading Hopper - Fuel Bin Loading Hopper - Sand Loading Hopper
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241-2	Rotary Airlock Valve
242-1	Fuel Transfer Screw No. 2
251-1	Materials Handling Gates
252-1	Flue Gas Dampers
253-1	Expansion Joints

BIDDER'S LIST

EXPANSION JOINTS (253-1)

Flexonics
6151 - 6th St. E.
Calgary, Alberta
T2H 1L9

RECEIVED
FEB 16 1984
FILE

INTEG VCR

FLEX CGY
FEB 16/84

ATTN: GRANT COOPER

REF: CANMET ARFBC RESEARCH FACILITY

FLEXONICS PROPOSAL: CA9403

WE HEREWITH SUBMIT OUR BUDGET PRICES FOR THE EXP JOINTS REQ'D FOR THE ABOVE PROJECT. WE HAVE DESIGNED IN ACCORDANCE WITH THE INFO PER YOUR TLX OF JAN 6/84 AND FURTHER INFO REC'D FROM YOURSELVES.

J1 - FLEXONICS STYLE FSF0405, T304 SS BELLOWS AND LINER C/W
150 LB DRILLING PLATE STEEL FLGES VANSTONED EA END
PRICE ----- 254.00 NET

J2 - FLEXONICS STYLE FSF0804 AS ABOVE
PRICE ----- 478.00 1NET

J3 - FLEXONICS STYLE FSF0603 AS ABOVE
PRICE ----- 430.00 NET

J6 AND J7 - FLEXONICS STYLE FSF0303 AS ABOVE
PRICE ----- 451.00 EA NET

J4 - FLEXONICS SPECIAL FSF0301, INCONEL 601 BELLOWS C/W INCONEL
601 LINER AND T316 SS FLGES VANSTONED EA END
PRICE ----- 1170.00 NET

J5 - FLEXONICS SPECIAL FSF0104 WITH INCONEL 601 BELLOWS AND LINER
AND T316 SS FLGES VANSTONED EA END
PRICE ----- 1873.00 NET

J8 - SPECIAL FSF0301 INCONEL 601 BELLOWS AND C/W T316 SS RAISED
FACE FLGES FIXED EA END
PRICE ----- 1390.00 NET

THESE ARE BUDGET PRICES, FOB OUR PLANT, BRAMPTON, ONTARIO
FST EXTRA AT 5
DELY 6 TO 8 WEEKS TO SHIPPING AFTER DRAWING APPROVALS

IF YOU SHOULD REQUIRE FURTHER INFO, PLSE DO NOT HESITATE TO CONTACT US

REGARDS
EUGENE SWEREDA
TECH SALES REP
FLEXONICS, CGY

FLEX CGY
03-826770

111-1

ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR

121-1
FORCED DRAFT BLOWER

BIDDERS LIST

FORCED DRAFT BLOWER (121-1)

Crocker Equipment Sales Ltd.
306 Industrial Avenue
Vancouver, B.C.
V6A 2P4

Attention: Mr. C.B. Crocker

P.J. Hannah and Associates
5350 Imperial Street
Burnaby, B.C.
V5J 1E6

Attention: Mr. J. Balderson

Pumps and Power Ltd.
1380 Napier
Vancouver, B.C.
V5L 2M4

BROCHURES INCL.

121-1

CROCKER EQUIPMENT SALES LTD.

306 INDUSTRIAL AVENUE, VANCOUVER, B.C. V6A 2P4

TELEPHONE 685-1462 · TELEX 04-53181

November 17, 1983

Intercontinental Engineering Ltd.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G.R. Cooper, P. Eng.
Project Manager

Dear Sir:

RE: Your File 0243-E1
Energy Mines and Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Equipment Cost Estimate

In response to your recent price inquiry we now enclose our quotation on the Aerzen air blower along with our supplier's technical information and sales literature.

We wish to thank you for this valued inquiry and, if we can be of further assistance, please do not hesitate to call.

Yours truly,

CROCKER EQUIPMENT SALES LTD.

Earl P. Vorrath
Sales Manager

EPV/sdd

Encl.

integ
NOV 18 1983
DATE
GRC
FILE

COMCO ROOTS COMPRESSOR CANADA INC.

QUOTATION No: Q-BP-831109 of: November 10, 1983

AERZEN ROTARY PISTON BLOWER

Type/size GMa 13 F 7

medium air

volume handled at intake condition	m^3/min	25		
volume handled at intake condition	m^3/h	1500		
density at intake condition	kg/m^3	1,184		
intake pressure (absolute)	bar	1,013		
discharge pressure (absolute)	bar	1,843		
pressure difference	mbar	830		
intake temperature	°C	21		
discharge temperature	°C	111		
blower speed	RPM	2640		
motor speed	RPM	1800 or 3600 your choice		
power consumption at blower shaft	kW	45		
motor rating	kW	51,75		
tolerances for volume handled at intake condition	%	5		
for power consumption at blower shaft	%	5		

COMCO ROOTS COMPRESSOR CANADA INC.

24 HOUR SALES AND SE CE – YE OUR

Quotation extra of Service Engineer

1) Daily rate: Can$ 400.00 per calendar weekday, based on 8 hours per day

2) Travelling extra.
Travel to and from Ottawa from Toronto or Montreal at cost

3) Hotel and meal accomodations at cost

4) Overtime + 50%

5) Saturdays and Sundays + 100%

121-1
CROCKER.

RECEIVED
DEC 01 1983
FILE

+
INTEG VCR

DCEQPT VCR
DEC 1/83 11:30 AM

ATTN MR G R COOPER
REF YOUR FILE 0243-E1

FURTHER TO OUR WRITTEN QUOTATION OF NOV/17/83 WE NOW OFFER THE FOLLOWING:

ONE ONLY 75HP RELIANCE MAXPAK PLUS DC VARIABLE SPEED DRIVE CONSISTING OF:

- 1 ONLY 75C60, 75 HP RELIANCE CONTROLLER 460/3/60 INPUT, NEMA 1 ENCLOSURE
- 1 ONLY 9C45 REMOTE OPERATORS STATION WITH START/STOP, RUN/JOG AND SPEED POT
- 1 ONLY 75 HP RELIANCE DC MOTOR, 1750 RPM 500 VOLT ARMATURE, TOTALLY ENCLOSED FAN COOLED.
  FRAME: D408ATZ, COMPLETE WITH 5PY TACHOMETER (MOUNTED)
- 1 ONLY 23C102 AUXILLIARY CONTACT KIT
  1 ONLY SPEED INDICATING METER (SUPPLIED LOOSE)
- 1 ONLY 93 KVA ISOLATION TRANSFORMER 575 VOLT PRIMARY, 460/3/60 SECONDARY
- 1 ONLY SPEED UP V DELT DRIVE

NOTE: THIS DRIVE DESIGNED TO PROVIDE 75 HP AT 3000 RPM

TOTAL PRICE 24,995.00
FOD: TORONTO ONTARIO
TAXES- EXTRA, IF APPLICABLE
DELIVERY: THREE MONTHS

IF THIS QUOTE IS SELECTED, YOU CAN DEDUCT 2,000.00 DLRS FOR THE MOTOR QUOTED IN THE ORIGINAL ORDER, SINCE ONLY ONE MOTOR IS RQUIRED.

TKS EARL P VORRATH
SALES MANAGER

CROCKER EQUIP SALES LTD
TELEX 04-53181

+
INTEG VCR

DCEQPT VCR

SCHEDULE I - SCHEDULE OF PRICES

FORCED DRAFT BLOWER

1.	Forced draft blower as described in the specification, FOB point of sale	$ 17,900.00
2.	Canadian Customs Duty 12.1 % of $ 8,000.00	$ 968.00 included in above price
3.	Transportation to site	$ 300.00
	TOTAL	$ 18,200.00

SCHEDULE II - TECHNICAL DATA

FORCED DRAFT BLOWER

1.0 SPECIFICATIONS

Manufacturer's name	Aerzener Maschinenfabrik	
Vendors name	Crocker Equipment Sales Ltd.	
Model and type	GMa 13 F 7 Rotary Piston Blower	
Volume	0.4166	m^3/s
Discharge pressure	83	kPa(g)
Discharge temperature	111	°C
Blower RPM	2640	
Diameter of suction	150	mm
Diameter of discharge	150	mm
Maximum power consumption	45	kW
Minimum flow	0.1666	m^3/s
Maximum noise level	76	dBA

Cooling method - fins on Blower housing - other cooling not required

Cooling water requirements N/A m^3/s

Drive type and specification - Leroy Somer or Canadian General Electric

Inlet filter type and size - Aerzen design Type 03/150 Weight: 10 lb.

Motor

- Manufacturer - Leroy Somer Can. or Canadian General Electric
- Power ouput 55 kW
- Speed - customer's choice 1800 or 3600 rpm
- Enclosure type - Aerzen design, Catalogue G1-951-07-EN page 6, left side bottom.
  Outside: Steel plate galvanized,
  Inside: Moltopren coated, easy assembly guaranteed

76dBA

- Temperature rise 90 °C
- Frame size - motor, Canadian General Electric 365

Optional variable speed drive

- Type To follow
- Manufacturer Not really necessary, because of high costs.
- Model Changing of volume possible by changing speed -
- Speed ratio inexpensive sheaves + belts.
- Power supply requirements ______ kVA ______ V ____ phase

Variable speed drive motor

- Manufacturer ______
- Power ouput ______ kW
- Speed ______ rpm
- Enclosure type ______
- Temperature rise ______ °C
- Frame size ______

Total weight ______ kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

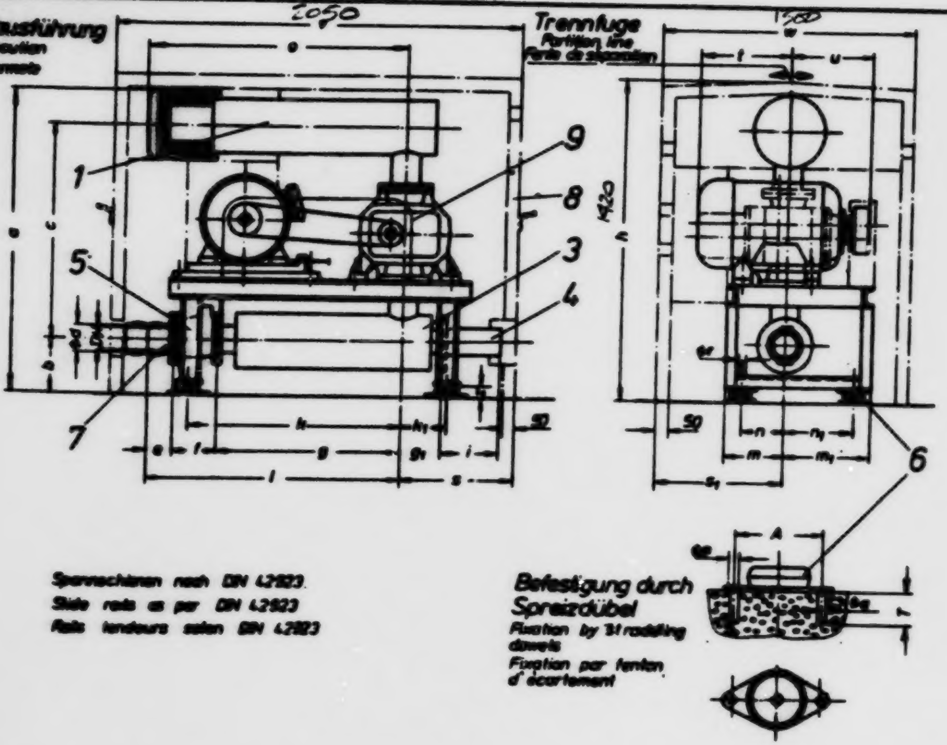
No extra cost for operating in unheated enclosure; No cooling water required; No other alternatives required for proper installation and operation; Regarding higher costs, variable speed drive not really recommended but possible - since a change of gears and belts is quick and inexpensive. Warranty on all parts of one year. Operating and Maintenance manuals free of charge. Start-up assistance not longer than 1-2 days. Many installations like this are operating already in Canada. This quote is all standard equipment for us. Recently we received an order for 8 units larger than this for the Genessee Power Project in Edmonton, Alberta.

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order

3 months

Standardausführung
Standard execution
Exécution normale



Spannschienen nach DIN 42923.
Slide rails as per DIN 42923
Rails tendeurs selon DIN 42923

Befestigung durch Spreizdübel
Fixation by straddling dowels
Fixation par tenton d'écartement

① Saugschalldämpfer mit Ansaugfilter	Inlet silencer with in inletfilter	Silencieux, coté d'aspiration avec filtre à l'aspiration
③ Druckschalldämpfer	Discharge silencer	Silencieux de refoulement
④ Druckventil	Pressure valve	Soupape de refoulement
⑤ Rückschlagklappe	Non return valve	Clapet antiretour
⑥ Elastische Maschinenfüße	Flexible machine feet	Pieds de machine élastiques
⑦ Anschluß für Gummimuffe.	Connection for rubber joint	Raccord pour manchon caoutc.
⑧ Schallhaube	Noise enclosure	Capot d'insonorisation
⑨ Riemenschutz	Belt guard	Protectrice pour la courroie

Bei Verwendung einer Schallhaube muß das Gebläse-Aggregat elastisch aufgestellt sein. Zur einfachen Wartung des Aggregates ist die Schallhaube auf Mitte geteilt und in Pfeilrichtung verschiebbar.

When using a noise enclosure the blower unit has to be flexibly mounted. For simplified maintenance of the unit the noise enclosure is divided in the middle and movable in direction of arrows.

Pour un capot de protection le groupe surpresseur doit être monté élastiquement. Pour l'entretien simplifié le capot est partagé en centre et déplaçable en direction de la flèche.

Bei Betrieb des Aggregates unter der Schallhaube nur Drehstrommotore der Schutzart JP54 verwenden.

Bauform B3 nach JEC-Norm. Klemmenkasten seitlich.

When operating the unit under the noise enclosure only use three-phase A.C. motors with type of protection JP54. Type of construction B3 to JEC-standard. Conduit box has to be located on left - or right hand side.

Pendant l'opération du groupe sous capot de protection utiliser seulement les moteurs à courant triphasé avec type de protection JP54. Type de construction B3 suivant JEC-standard. Boîte de bornes placée à droite ou à gauche.

Rohrstutzen nach JSO; Pipe socket acc. to JSO; Tubulure suivant JSO.

Flansche nach DIN 2642, Flanges acc. to DIN 2642; Brides suivant DIN 2642.

Type	Motor-Type	a	b	c	Ød	e	f	g	g₁	h	i	k	k₁	l		m	m₁	n	n₁	o	Øp	Øq	Ør	s	s₁	t	u	v	w	z	DN	A	T	Gewicht kg m.Motor ca.
GMa13.6	[illegible]	1370	265	950	159	135	265	925	200	1420	240	1000	200	1325		320	430	250	360	1240	13	13	13	600	650	330	370	2050	1300	40	150	140	50	580
	[illegible]											1100																						710
	[illegible]											1200				390		320								375								805
	[illegible]	1515		1085						1600																450		2150						870
	[illegible]											1300				480	450	410	380							520								1015
GMa13.7	[illegible]	1370	265	950	159	135	265	925	200	1420	390	1000	200	1325		267	483	197	413	1240	13	13	13	600	650	383	423	2050	1300	40	150	140	50	590
	[illegible]											1100																						740
	[illegible]											1200				337		287																835
	[illegible]	1515		1085						1600																397		2150						900
	[illegible]											1300				427	503	357	433							467								1045
GMa13.8	[illegible]	1370	265	950	159	135	265	925	200	1420	390	1000	200	1325		317	553	247	483	1240	13	13	13	600	650	453	483	2050	1300	40	150	140	50	700
	[illegible]											1100																						850
	[illegible]											1200																						985
	[illegible]	1515		1085						1600																		2150						1020
	[illegible]											1300				387	673	287	503															1175

Aerzener Maschinenfabrik G m b H
D-3251 Aerzen 1

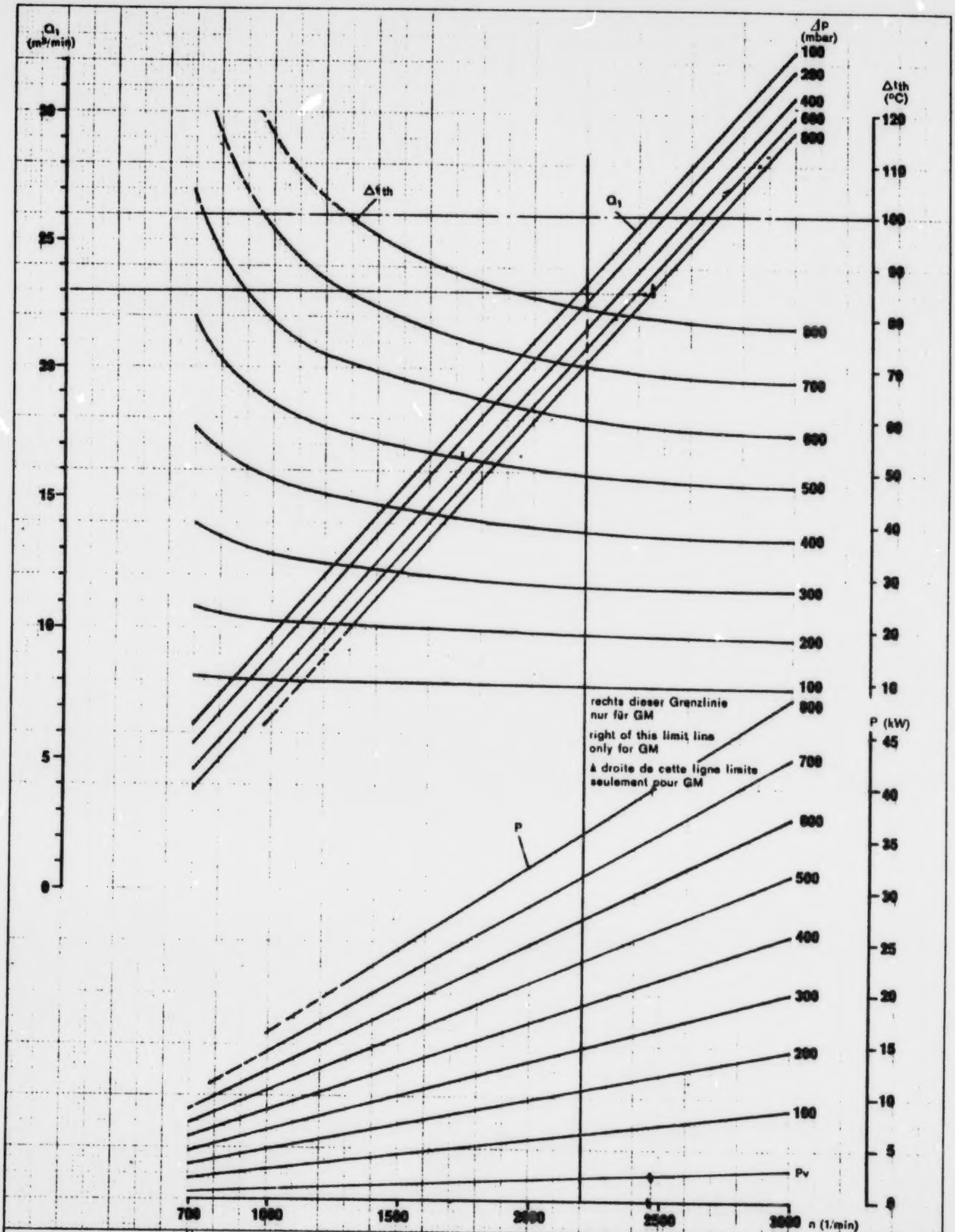
Drehkolbengebläse-Aggregat

GMa 13.. fliegender Antrieb; Überdruck
Rotary piston blower unit GMa 13...use of overhung pulley; overpressure
Groupe surpresseur à pistons rotatifs GMa 13 ..commande en porte-à-faux; surpression

ZZG-2641 XL

gezeichnet	4.3.76	
geprüft	7.3.76	

Ersatz f. Zchng ZZG-2304
Änderung: März 82



q_0 = 11,36 l/U Q_{v100} = 1,6 m³/min bei/at/à ϱ = 1,293 kg/m³	Q_1	Ansaugvolumenstrom (Luft) bei ϱ_1 = 1,2 kg m³	Induced volume flow (air) at ϱ_1 = 1,2 kg m³	débit effectivement aspiré (air) pour ϱ_1 = 1,2 kg m³
	P	Leistungsbedarf an der Kupplung	power consumption at the coupling	puissance absorbée à l'accouplement
	Δt_{th}	theoretische Temperaturerhöhung bei ϱ_1 = 1,2 kg m³ und cp = 1,0 kJ kg K	theoretical temperature increase at ϱ_1 = 1,2 kg/m³ and cp = 1,0 kJ/kg K	elévation de température théorique pour ϱ_1 = 1,2 kg m³ et cp = 1,0 kJ/kg K
	Δp	Druckerhöhung	pressure difference	pression différentielle

Leistungsdiagramm – Überdruck – für Drehkolbengebläse
performance diagram – overpressure – for Rotary Piston Blower

und
and

121-1

P.J. HANNAH EQUIPMENT SALES CORP.

☒ 5350 IMPERIAL ST., BURNABY, B.C. V5J 1E6 TEL. (604) 430-1531 TELEX 043-54844
☐ 8720A - 51 AVE., EDMONTON, ALBERTA T6E 5E8 TEL. (403) 468-5655 TELEX 037-42601

83-11-29

Intercontinental Engineering Ltd.
1155 West Pender Street
Vancouver, B. C.
V6E 2P4

Our Reference H1145 Rev. A

ATTENTION: Mr. G. R. Cooper, P. Eng.

SUBJECT: File No. 0243-43B
Combustion Air Blowers

Gentlemen:

We are pleased to supply the following quotation per your request.

One (1) only Gardner-Denver Model 7CDL11 positive displacement blower, 12 psig, 5" flanged connection.

intec
NOV 29 1983
CIRC. DATE
GRC

Net volume at 12 psig - 800 ICFM. ✓

Maximum design pressure - 12 psig. ✓

Blower speed - 2,424 RPM.

Horsepower requirements - 63 BHP.

Accessories

- Elevated extended base for jackshaft drive c/w motor slide base.
- Jackshaft "V" belt drive.
- Belt guard. ✓
- 75 HP, 3/60/575 volt, 1800 RPM, T.E.F.C. electric motor. ✓
- Model 8502511 intake filter-silencer c/w hood and 6" MPT-5" flange adapter. ✓
- Premium construction horizontal discharge silencer c/w 5" flanges. ✓
- Premium construction vertical discharge silencer c/w 5" flanges. ✓
- 90° flanged discharge elbow, 5" blower flange to 5" pipe. ✓

Accessories (Cont'd.)

- *Inlet expansion joint - 5" metallic.* ✓
- *Discharge expansion joint - 5" metallic.* ✓
- *Discharge check valve less flanges for 5" discharge pipe.* ✓
- *Pressure relief valve, spring type, factory set to your specifications within 14 psig range.* ✓
- Acoustic hood ?
- Startup Assistance ?

TOTAL PRICE:	*$ 25,875.00*

Price quoted is in Canadian funds.

Duty and brokerage included.

Applicable taxes extra.

F.O.B. Ottawa, Ontario.

Terms: Net thirty (30) days from date of shipment, upon approved credit. If goods are held in storage at customer's request, the invoice will be issued when the goods are ready for shipment and becomes due thirty (30) days thereafter. Overdue accounts are subject to 2% interest charge per month.

Please note, currency exchange to Canadian funds and duty are at today's prevailing rate. We reserve the right to debit or credit your account if the aforementioned rates vary by more than 1% at the time of importation in the case of duty, or at the time at which we receive your payment in the case of currency exchange.

The above prices are net and firm for purchase by 83-12-29 and shipment within the normal equipment schedule.

Shipment from the factory will be made approximately 8 - 9 working weeks from receipt of approved drawings (or waiver of drawings approval) and purchase order in the manufacturer's Engineering Dept.

Warranty per attached Gardner-Denver warranty.

IMPORTANT! Blower assemblies are "shop" aligned only prior to shipping. It is essential, therefore, that they be properly levelled and realigned per the manufacturer's instructions by qualified personnel when installed on site. Failure to do so will void warranties and may result in severe or irreparable damage to the blower and/or related equipment or accessories.

Field set-up as described above is not included in this proposal. However, assistance is available at the rate of $350.00 per day, plus travel and living expenses, to supervise qualified tradesmen supplied by others.

Upon receipt of order we will supply three (3) bound manuals containing operating maintenance instructions and spare parts list for equipment detailed in this quotation. Additional copies are available at $25.00 per copy.

Please note the attached Gardner-Denver Standard Terms and Conditions of Sale, as well as P. J. Hannah Equipment Sales Corp. Standard Terms and Conditions of Sale, both of which form part of this proposal.

Should we be favoured with your order, we would appreciate this being forwarded to P. J. Hannah Equipment Sales Corp., 5350 Imperial Street, Burnaby, B. C. V5J 1E6.

If you require any further technical information, please feel free to contact the writer.

Yours truly,

P. J. HANNAH EQUIPMENT SALES CORP.

Hannah

for John Balderston
Technical Sales Representative

JB/ew

Enclosures: Schedule I - Schedule of Prices
Schedule II - Technical Data
Standard Terms and Conditions of Sale

SCHEDULE I - SCHEDULE OF PRICES

FORCED DRAFT BLOWER

1.	Forced draft blower as described in the specification, FOB point of sale	$ 24,760.00
2.	Canadian Customs Duty _____ % of $ __________	$ N/A
3.	Transportation to site	$ 1,115.00
	TOTAL	$ 25,875.00

SCHEDULE II - TECHNICAL DATA

FORCED DRAFT BLOWER

1.0 SPECIFICATIONS

Manufacturer's name	*Gardner-Denver*	
Vendors name		
Model and type	*7CDL11 Helical Screw*	
Volume	*.38*	m^3/s
Discharge pressure	*83*	kPa(g)
Discharge temperature	*177*	°C
Blower RPM	*2424*	
Diameter of suction	*203*	mm
Diameter of discharge	*203*	mm
Maximum power consumption	*52*	kW
Minimum flow	*.38*	m^3/s
Maximum noise level	*84*	dBA
Cooling method	*Air cooled*	
Cooling water requirements	*N/A*	m^3/s
Drive type and specification	*9" blower pulley* *V-belt 12" motor pulley*	
Inlet filter type and size	*Air Maze Dry Type* *800 CFM capacity*	
Motor		
- **Manufacturer**	*General Electric*	
- **Power ouput**	*62*	kW
- **Speed**	*1800*	rpm
- **Enclosure type**	*T.E.F.C.*	

- **Temperature rise** ____40____ °C
- **Frame size** ____365T____

Optional variable speed drive

- **Type** ________________
- **Manufacturer** ________________
- **Model** ________________
- **Speed ratio** ________
- **Power supply requirements** ______ **kVA** _____ **V** ___ **phase**

Variable speed drive motor

- **Manufacturer** ________________
- **Power ouput** ________ **kW**
- **Speed** ________ **rpm**
- **Enclosure type** ________________
- **Temperature rise** ________ **°C**
- **Frame size** ________

Total weight ________ **kg**

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

____

____

____

____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order	*8 - 9 working weeks from receipt of approved drawings and purchase order.*

P.J. HANNAH EQUIPMENT SALES CORP.
STANDARD TERMS AND CONDITIONS OF SALE

ORDERS, ACCEPTANCE AND CANCELLATION

Any order based upon this proposal must be received within thirty days from the date hereof and is subject to acceptance by an officer of P.J. Hannah Equipment Sales Corp.

This proposal may be varied or withdrawn by us before any order based on it is accepted by us.

Any order based on this proposal will not be subject to cancellation without our consent.

PRICES

As all of our prices from manufacturers are subject to change without notice, it is understood that the prices quoted by us herein are also subject to change without notice.

Prices quoted herein are exclusive of applicable provincial and federal sales taxes and customs duties (unless otherwise stated).

When prices quoted are inclusive of duty, exchange and freight as calculated by us at the date hereof, they are subject to increase or decrease in accordance with any changes in tariffs, imports, or rates applicable at time of delivery or other relevant time.

LIABILITY. WAIVER

If accepted it is understood that we shall not be reponsible for failure to deliver or delay in making delivery if such failure of delay is caused by the discontinuance of production by the manufacturer, strikes, lockouts, or other labour difficulties, accidents, fire, flood, acts of God or of the public enemy, riots, civil disturbances, martial laws, acts of government, shortages of fuel or of raw material, delays or stoppages of transportation, or other causes beyond our control. If as a result of one or more of the foregoing causes it is not reasonably possible for us to make delivery at the date or dates specified then the time for making delivery may at our option be extended for a period of time equal to the duration of any such delaying causes.

WARRANTY. WAIVER

Any statements or guarantees covering designs, materials, workmanship and performance are understood to be those of the manufacturer or producer of the equipment or material quoted upon herein. We do not in our own name or for ourselves make, confirm, warrant or underwrite any such statements or guarantees.

We are not to be liable in any event for damage, whether direct or indirect, which may be caused by defective design, material, workmanship or otherwise.

LOSS BREAKAGE OR DAMAGE

Any claim for loss, breakage or damage (obvious or concealed) are Buyer's responsibility and should be made to the carrier. Seller will render Buyer reasonable assistance in securing satisfactory adjustment of such claims. Any notices of shortages or other errors must be made in writing to Seller within seven days after receipt of shipment. Failure to give such notice shall constitute unqualified acceptance and a waiver of all claims by Buyer. Risk of loss for damages to the products sold hereunder passes to Buyer upon delivery to the carrier regardless of who pays shipping costs. Title to the products sold hereunder passes to Buyer upon payment of the full purchase price, plus any applicable interest if account is overdue.

LIMITATION ON LIABILITY

Seller's sole responsibility and Buyer's sole and exclusive remedy with respect to any claim under this proposal shall be limited to repair, replacement or repayment of the purchase price at Seller's sole option. Seller's total responsibility and liability for any and all claims, damages of any nature, losses, liability or costs of corrective efforts, including but not limited to those relating to any warranty or guarantee arising out of or related to performance of this agreement of the products covered hereunder or the performance thereof shall not exceed the purchase price. In no event shall Seller be liable for any special, indirect, incidental or consequential damages of any character, including but not limited to, loss of use of productive facilities or equipment, lost profits, property damage, expenses incurred in reliance on Seller's performances hereunder, or lost production, whether suffered by Buyer or any third party. Seller disclaims all liability for any and all costs, claims demands, charges expenses or other damages, either direct or indirect, incident to all property damages arising out of any cause of action based on strict liability.

ASSIGNMENT

Buyer shall not (by operation of law or otherwise) assign its rights or delegate its performance hereunder without the prior written consent of Seller, and any attempted assignment or delegation without such consent shall be void.

MODIFICATION. RECISSION AND WAIVER

This contract may not be modified or rescinded nor any of its provisions waived unless such modification, rescission or waiver is in writing and signed by an authorized employee of Seller at its office.

MISCELLANEOUS

The rights and duties of the parties and construction and effect of all provisions hereof shall be governed by and construed according to the law of the Province of British Columbia.

TERMS

Title to all equipment or material covered by any accepted order shall not pass until payment thereof is made in full.

Unless otherwise specified, terms are thirty days net from date of invoice. Interest at 24 percent per annum is payable on overdue accounts.

Any errors or omissions in this proposal are excepted.

(BROCHURES INCL.)

121-1

integ
NOV 21 1983
DATE
GRC

QUOTATION #VO-513-3

November 9, 1983

Integ Limited
1155 West Pender Street
Vancouver, B.C.
V7E 2P4

Attention: Mr. G.R. Cooper, P. Eng.
Project Manager

Dear Sir:

RE: YOUR FILE 0243-E1
ENERGY MINES & RESOURCES CANADA LTD.
EQUIPMENT COST ESTIMATE

We are pleased to quote budget pricing on the forced draft blower package as requested by you in your specifications as follows:

1 Only Sutorbilt series 4500 model 711 8"x8" rotary positive blower, operating at 1589 RPM requiring 65.02 BHP at 800 ACFM and 12 PSIG discharge pressure. Complete with a Kunkle 2"x12# spring loaded relief valve, 2 8" flanged flexible connectors, 8" flanged Sutorbilt check valve weighted type with adjustable outside lever, Universal model RD-8 discharge silencer, Universal model UCI-8 inlet silencer and Universal model FH-8-2 inlet filter with 2 only W2 panels. Mounted on a fabricated steel baseplate c/w v-belt drive, v-drive guard and 75 HP, 1750 RPM, 575 volt, 3/60 Hz, TEFC 365 T frame electric motor. Baseplate supplied with vibration isolators and a complete blower package surrounded by an acoustic cabinet with 4" wall thickness and with cut-outs for piping, cut-outs for vents and complete with a 300 SCFM fan.

COMPLETE PRICE.....................$19,668.00

70 YEARS

PUMPS & POWER LTD.
MOUNT PRODUCTS
ES AND SERVICE

HEAD OFFICE & FACTORY
1380 NAPIER STREET
VANCOUVER, B.C. V5L 2M4
PHONE (604) 255-4341
TELEX 04-54463

BRANCH OFFICES
CALGARY – EDMONTON

...2/

Conditions of Sale:
This quotation is subject to the terms and conditions appearing on the reverse side.

TERMS AND CONDITIONS

1. All orders for products or services of Pumps & Power Ltd. (hereinafter called the "Company") are subject to these terms and conditions. No modifications of, or additions to, these terms will be recognized by the Company unless specifically agreed to in writing by an officer of the Company.

2. This is a quotation only and is not binding on the Company unless accepted within thirty days from the date hereof and thereafter approved by the Company. Prices are subject to change without notice.

3. This quotation and any contract resulting herefrom, including the terms of payment specified, is subject to the purchaser demonstrating and maintaining a financial position satisfactory to the Company up to the date of shipment.

   If the financial position of the purchaser at any time does not, in the judgement of the Company, justify continuance of the work to be performed, the Company may require full or partial payment in advance, or shall be entitled to cancel the contract and shall receive payment for its reasonable and proper cancellation charge.

4. The Company warrants pumps of its own manufacture against defects in materials and workmanship, under normal use and service, for a period of one year after date of shipment from its factory. The Company's obligation is limited to repairing or replacing, at its option, without charge, F.O.B. its factory, any part of its own manufacture which is proven to have been defective at time of shipment; provided immediate written notice is given to the Company at the time such defect is discovered. It shall be the Company's option to require the return of the defective material, transportation prepaid, to establish the claim.

   The Company shall in no case be responsible for labour charges, loss, consequential damage or delay as a result of any such defect. No allowance will be made for repairs or alteration, unless authorized previously in writing.

   This warranty does not apply to any failure attributable to corrosive or abrasive attack.

   For equipment included in this quotation but manufactured by others, the Company will endeavour to assign to the Purchaser the warranties extended by such manufacturers to the Company.

   The manufacturers of these materials including motors, engines, controls, accessories etc., will not allow any claims for service, labour or other expenses which they have not previously authorized in writing.

5. All equipment shall be delivered to the Purchaser, F.O.B. point of shipment. Unless provided to the contrary, shipments will be made via carriers and routes selected by the Company with freight charges to be assumed by the Purchaser. The risk of loss or damage, patent or otherwise, shall pass to the Purchaser upon delivery to the carrier. Shipping dates are approximate and are based upon prompt receipt of all necessary information from the Purchaser. Where a period is named for delivery, and such period is not extended by mutual consent in writing, the Purchaser shall take delivery within that period.

6. The Company shall not be liable for delays caused by fire, elements, rebellions, riots, strikes, labor troubles or civil commotion of any kind or by delays in transportation or in procuring labor, material or supplies, or any other matters of like or different character beyond the reasonable control of the Company. Receipt of the equipment by the Purchaser upon delivery shall constitute a waiver of all claims for delay.

7. The Company shall retain title to all equipment furnished under this quotation until full payment has been received. Should the Purchaser default in making any payment when due the Company will be free to enter the premises where such equipment may be located and remove the same as its property whatever may be the mode of its attachment to realty or other property without prejudice to any further claims on account of damage which the Company may suffer by reason of the Purchaser's refusal or failure to surrender the equipment when required to do so. The Company may sell any equipment repossessed as aforesaid and the Purchaser shall remain liable to the Company for any deficiency. Claims for shortages must be made within ten days after receipt of the material.

8. Terms of payment are net thirty days from shipment to approved accounts. A service charge of 1½% per month will be levied against all past due accounts. All payments are to be made in Canadian funds at par, Vancouver, B.C.

ALTERNATIVE

As above but with direct drive baseplate and including a DC drive package including DC motor, TEFC motor enclosure, etc.

Variable speed drive comprising of:

1 Only wall MTG thyristor controller rated 75 HP and designed for operation on 460/3/60 Hz supply with following features:

- incoming circuit breaker with through the door handle
- current limiting fuse
- surge protection from AC line and DC load transients
- phase sequence interlock and indicator light
- line loss protection
- field (voltage) loss protection
- instantaneous electronic trip (IET)
- adjustable current limited
- solid state motor thermal overload protection
- armature contactor rated to break full load current
- isolating feedback
- 115 volt AC control transformer
- drive start/stop and speed control
- separately adjustable rates of linear acceleration and deceleration
- jog at adjustable preset speed by pushbutton or selector switch
- 150% one minute current rating
- Adjustments:
    - Maximum Speed
    - Minimum Speed
    - Acceleration Rate
    - Deceleration Rate
    - Job Speed
- unidirectional operation, coast-to-rest on stop command
- Adjustments:
    - IR Drop Command
    - Current Limit

1 Only Reliance DC motor rated 75 HP at 1750 RPM TEFC, F/S B408ATZ, and suitable for speed control down to 60% speed against constant torque.

PRICE..............................$39,744.00

...3/

OPTIONAL

1 Only isolation transformer rated at 93kva with 575 volt, 3 phase, 60 Hz primary and 460 volt, 3 phase, 60 Hz secondary.

PRICE..............................$ 2,310.00

Please find literature and specifications enclosed.

Prices are Federal sales tax and Provincial sales tax not included.

Delivery is 12-14 weeks from receipt of firm order.
FOB point is our Vancouver warehouse.

Pumps & Power Ltd. standard terms are net 30 days to approved accounts or as mutually agreed.

Yours truly,

F. Gray

C.F. (Fred) Gray
Manager
INDUSTRIAL SALES

CFG/pmf

Encl.

131-1

IGNITION BURNER

131-1

BIDDER'S LIST

IGNITION BURNER (131-1)

ICG Energy Products Ltd.
3181 Thunderbird Crescent
Burnaby, B.C.
V5A 3G1

Attention: Mr. H. Tremblay

Inproheat Industries Ltd.
680 Raymur Avenue
Vancouver, B.C.
V6A 2R1

Attention: Mr. B. Rothwell

Cal-Van Engineering Ltd.
3927 Grant Street
Burnaby, B.C.
V5C 3N4

Attention: Mr. H.L. Walker

Fleck Bros. Ltd.
110 Alexander Street
Vancouver, B.C.
V6A 1B6

Attention: Mr. F.W. Johnson

Trecan Limited
4540 Dixie Road
Mississauga, Ont.
L4W 1N2

Attention: Mr. R.C. Parker

131-1

INPROHEAT

INPROHEAT INDUSTRIES LTD. / 680 RAYMUR AVENUE, VANCOUVER, B.C., CANADA V6A 2R1

TELEPHONE (604) 254-0461
TELEX 04-51370
CABLE ADDRESS INPROHEAT

integ
DEC-9 1983
GRC

07 December 1983

Integ
1155 W. Pender Street
Vancouver, B.C.
V6E 2P4

Attn: Grant Cooper, P. Eng.
Project Manager

RE: P8334 Ignition Burner
Project 0243, Energy Mines and Resources Canada
ARFBC Research Facility

In response to your inquiry, Inproheat is pleased to provide the following quotation for the supply of an ignition burner and associated fuel train and flame safeguard.

Scope of supply includes the following:

- one only, Pyronics 1001 NM to fire propane gas to 1.5 million BTU per hour; complete with gas adjuster and spark ignited pilot.
- one only, Fuel Train Assembly complete with components as shown on attached schematic; assembled, and pre-piped on structural frame.
- one only, Local Control Panel, mounted and pre-wired to fuel train components complete with flame relay/amplifier, ignition transformer, push buttons and indicating lights.
- one only, Pyronics Ultraviolet Flame Scanner

Total Price:.. $ 9,310.00

OUR 25th YEAR

INPROHEAT

Terms and Conditions of Sale

This proposal is subject to our standard Terms and Conditions of Sale, attached to and forming part of this proposal.

Clarifications

1. Burner quoted is suitable for a maximum combustion chamber back pressure of 4 psig.
2. Price is for supply of equipment only and does not include installation or start-up.
3. Burner firing rate adjustment is manual.

We trust our proposal meets your requirements and we look forward to discussing it with you in the near future. If you require further information, please contact me at your convenience.

Sincerely yours,

INPROHEAT INDUSTRIES LTD.

B Rothwell

Bruce R. Rothwell, P. Eng.
Project Engineer

BRR:sg
Enclosures

INPROHEAT

TERMS AND CONDITIONS OF SALE

The following terms and conditions apply to this submission and to orders derived from it, unless specifically changed in writing.

F.O.B. Point:	☒ Vancouver, B.C.	☐ Edmonton, Alberta
	☐	
Federal Sales Tax is:	☒ Not Included	☐ Included
Provincial Sales Tax is:	☒ Not Included	☐ Included
Canadian Customs Duty is:	☐ Not Included	☒ Included where applicable
	☐ Not Applicable	
Currency:	☒ Canadian Dollars	☐ ....
Exchange Rate Basis:	☒ $1.00 Canadian Dollar = $ 0.80 U.S.	
	☐ Not Applicable	
Delivery:	☒ Drawings: 2 weeks after receipt of order, Equipment:10 weeks after drawing approval	
Terms of Payment:	☒ Net 30 Days	
	☐	
Quotation open for acceptance to:	January 6,1984	

Note: Duty is applicable to approximately 10% of total price.

See over for General Conditions of Sale.

INPROHEAT

1. **PAYMENT.**
Net 30 days, unless otherwise stated.

2. **OVERDUE ACCOUNTS**
Interest at the rate of Prime plus 2% per month will be applied to all overdue accounts.

3. **TAXES**
Unless otherwise stated, the quotation prices do not include Federal or Provincial Sales or Excise Taxes of any nature.

4. **COST CHANGES**
Changes in cost, caused by factors beyond our control, and which can be specifically accounted for, such as, but not limited to, tariff rates, sales or other such taxes, etc. are for your account and will result in a commensurate adjustment to the contract price.

5. **FOREIGN EXCHANGE RATES**
For goods originating outside of Canada, the exchange rate on which the quotation is based will be specified in the quotation. Canadian funds prices can be confirmed and finalized upon notification of intent to purchase.

6. **SHIPPING**
Unless otherwise stated, this equipment will be shipped from stated F.O.B. point at your risk and it is your responsibility to provide suitable insurance covering all hazards during shipping, handling and erection. This equipment will be shipped when ready. However, if you are not prepared to receive it, we will store it at your expense and the foregoing terms of payment will apply, as if the material had been shipped.

7. **WARRANTY**
We warrant the subject equipment of our manufacture to be free of defects of workmanship or material for a period of one year from the date of start-up, or fifteen months from the date of shipment, whichever period first expires. Purchased equipment or equipment items purchased by us for inclusion within this quotation will carry only the warranties, if any, provided by their manufacturer. Parts found to be detective shall be shipped prepaid to our warehouse or the factory of our supplier (at our instruction) and shall be repaired or replaced at the discretion of ourselves and our supplier and reshipped F.O.B. point of repair or replacement. This warranty does not apply to refractory materials or to parts whose normal service life is less than the warranty period or to equipment that is improperly used, maintained or lubricated. Modifications, alterations, installation and start-up procedures carried out by others and not approved by INPROHEAT, shall void the terms of this warranty. Warranty services shall be carried out at straight time labour rates. Additional costs occasioned by performing such work at premium time or overtime rates shall be for your account. There are no other warranties or conditions of sale, expressed or implied, in connection with this quotation, and we shall not be liable for incidental or consequential damages of any nature.

8. **PATENT INFRINGEMENT**
We will indemnify and protect you, at our expense, against infringement or claim thereof, of any Canadian Patent covering the subject machinery where such machinery is designed or specified by us. No liability will be assumed by us for the infringement of any patent rights asserted because of the nature, structure, or use of any equipment specified by you, and you agree to hold us harmless against any such claim.

9. **SAFETY DEVICES**
Only those safety devices specified in this quotation, shall be provided, and it is your responsibility to provide or cause us to provide such safety devices as are required or are necessary to meet all safety codes and statutes. The provision of such additional devices, if any, would be extra to the quoted price.

10. **DELIVERY**
Delivery dates and/or schedules are our best estimates at this time. We shall not be responsible for any additional costs, consequential damages, or damages of any nature caused by changes in such dates or schedules.

11. **LOSSES ON JOB SITE**
In the event that material and equipment delivered to your plant or job site, is subsequently damaged or destroyed by causes such as, but not limited to, fire, the elements, or any other cause not due to our fault or negligence, you are to reimburse us at our prevailing selling prices, for the repair, replacement, etc., as required.

12. **TITLE AND OWNERSHIP**
Title and ownership and right of repossession of the machinery and equipment herein described shall not pass to the purchaser, but shall remain, with INPROHEAT until the full amount to be paid has been paid in full and all conditions performed by the purchaser.

13. **ACCEPTANCE OF ORDER**
An order submitted pursuant to this proposal is subject to final acceptance by our office. We shall not be held responsible for errors in typing, arithmetic, etc., that may occur in the preparation of this proposal.

14. **CANCELLATION OF ORDER**
An order is not subject to cancellation except with our consent, and only after a request for cancellation is submitted by you in writing, agreeing to pay all costs incurred at current prevailing selling rates.

15. **LOSSES, DAMAGES OR DELAYS, ETC.**
We will not be liable for any loss, damage, or delay due to transportation, fire, labour dispute, civil or military authority, insurrection or riot, or any cause reasonably beyond our control.

16. **LAWS OF BRITISH COLUMBIA / ALBERTA**
This proposal and any order submitted pursuant thereto shall be governed by and construed in accordance with the laws of B.C. if quote issued from B.C. office or Alberta if quote issued from Alberta office.

17. **ESCALATION**
Escalation and escalation terms, if applicable, shall be stated in an individual quotation.

18. **DESIGN**
The Company reserves the right at any time to discontinue the manufacture or supply of any model or make changes in design [illegible] add improvements to products without incurring any obligation to furnish or install the same on products previously manufactured. When parts or assemblies are to be used in connection with an existing installation the Company will furnish parts as nearly interchangeable as feasible at the time.

19. **WEIGHTS**
Weights quoted are estimated shipping weights only.

20. **LIMITATION OF LIABILITY**
INPROHEAT shall not be responsible for the acts and workmanship of the employees, contractors, sub-contractors or agents of the purchaser. INPROHEAT shall not be liable to the purchaser for any loss or injury to persons or property caused in whole or in part by the negligence of the purchaser, its employees, contractors, suppliers or their employees, agents or sub-contractors. In no event shall INPROHEAT be liable for special, indirect or consequential damages.

21. **FIELD SERVICE**
Services of factory field service personnel for installation supervision, start-up and adjustment and subsequent technical assistance may be purchased at standard prevailing rates.

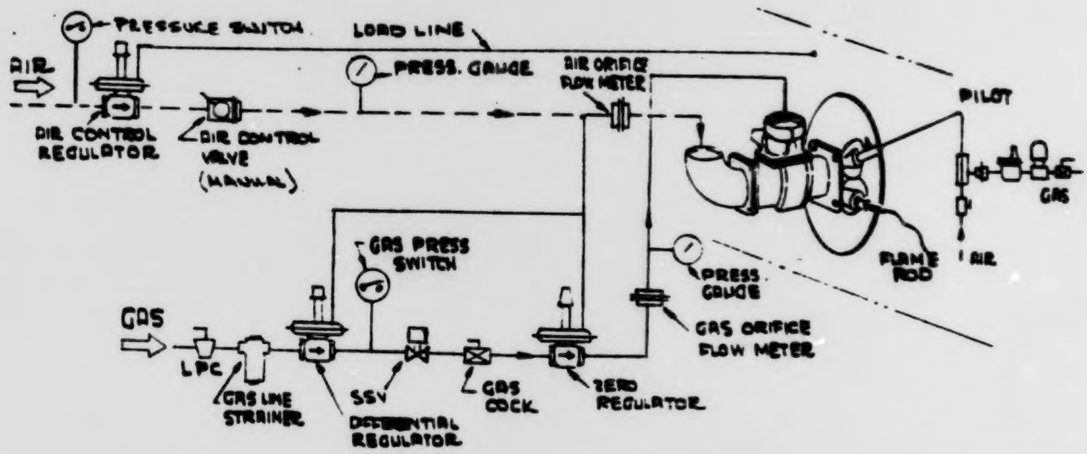
22. **RETURNED MERCHANDISE**
Returned merchandise will be accepted only on specific written authority, and only after you have agreed to pay all costs associated with the return at the currently prevailing rates.

23. **EMERGENCY ORDERS**
Emergency orders can and will be handled to our fullest capability. To do so, special handling and personal expediting is required from order to receipt to shipment. Obviously such handling involves considerably more cost than routine handling, therefore, such handling will be employed only upon request and with the full understanding that special handling charges may be added to the selling price.

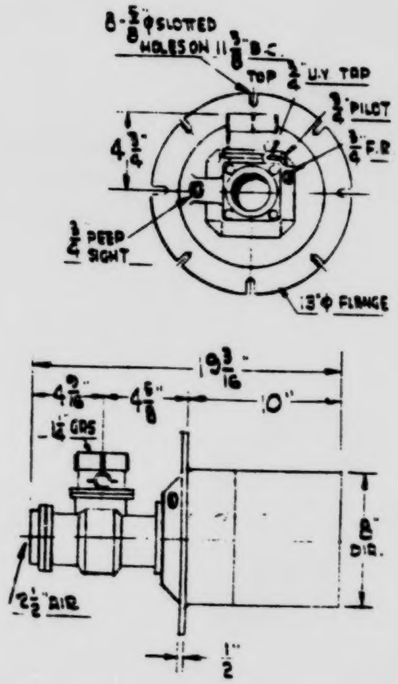
24. **GOVERNING CONDITIONS**
These foregoing conditions shall govern all future dealings between the parties relating to the subject matter of this quotation, and shall govern in the event of any conflict with any general printed conditions contained in any documents submitted by the purchaser.

INPROHEAT INDUSTRIES LTD.

680 Raymur Avenue
Vancouver, B.C. V6A 2R1


PRESSURE SWITCH
LOAD LINE
AIR
PRESS. GAUGE
AIR ORIFICE FLOW METER
PILOT
AIR CONTROL REGULATOR
AIR CONTROL VALVE (MANUAL)
GAS
AIR
FLAME ROD
GAS PRESS SWITCH
PRESS. GAUGE
GAS ORIFICE FLOW METER
GAS
LPC
GAS LINE STRAINER
SSV
DIFFERENTIAL REGULATOR
GAS COCK
ZERO REGULATOR

PROPOSED SCHEMATIC - BACK PRESSURE FIRING
WITH AIR REGULATION


8-5/8" φ SLOTTED HOLES ON 11 3/8" B.C.
TOP
1/2" U.V. TAP
3/4" PILOT
3/8" F.R.
4 3/4"
3/4" PEEP SIGHT
13" φ FLANGE
19 3/16"
4 9/16"
4 5/8"
10"
1 1/4" GAS
8" DIA.
2 1/2" AIR
1/2"

PYRONICS 1001 NM
NOZZLE MIX BURNER

INPROHEAT
INDUSTRIAL PROCESS HEAT ENGINEERING LTD.

PROPOSED IGNITION BURNER &
FUEL TRAIN SCHEMATIC FOR INTEG.

THIS DRAWING IS SENT TO YOU WITH THE UNDERSTANDING THAT IT IS NOT TO BE REPRODUCED, COPIED OR USED, DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO OUR INTERESTS

DRAWN B.R.
REV. DATE
DWG. No. P8334-01

FLECK BROS. LIMITED
SERVICE TO INDUSTRY SINCE 1907
110 ALEXANDER ST., VANCOUVER, B.C., CANADA V6A 1B6
PHONE 684-8131 – TELEX 04-53205

QUOTATION 131-1

WHEN ORDERING PLEASE REFER TO THIS QUOTATION NUMBER AND DATE BELOW.
1043 - 11 - 83
DIVISION ENVIRONMENTAL DIV.
DATE NOVEMBER 24, 1983

PROPOSAL TO

INTEG
INTERCONTINENTAL ENGINEERING LTD.
1155 WEST PENDER STREET
VANCOUVER, B.C.
V6E 2P4

ATTENTION: G. R. COOPER, P. ENG

ESTIMATED DELIVERY DATE 8 WEEKS
TERMS NET 30
FEDERAL SALES TAX EXTRA
PROV. SALES TAX EXTRA
F.O.B. VANCOUVER

WE PROPOSE TO SUPPLY THE FOLLOWING DESCRIBED PRODUCTS AT THE PRICES QUOTED, SUBJECT TO THE TERMS AND CONDITIONS NOTED HEREON.
WE WILL MAKE EVERY EFFORT TO MAINTAIN DELIVERY AS QUOTED BUT CANNOT GUARANTEE SHIPPING DATES.
THIS PROPOSAL IS SUBJECT TO ACCEPTANCE WITHIN 30 DAYS UNLESS OTHERWISE NOTED.

REFERENCE: ENERGY MINES & RESOURCES CANADA
A.R.F.B.C. RESEARCH FACILITY
SUPPORT BURNER - IGNITION

TO SUPPLY ONLY:

(A) AS PER SCHEDULE I - SCHEDULE OF PRICES

(B) SCHEDULE II - TECHNICAL DATA

TOTAL PRICE $11,245.00

FWJ/as
encls.

THE PRICES QUOTED HEREIN ARE BASED UPON EXISTING FACTORY PRICES, RATES OF EXCHANGE, DUTIES, TAXES AND FREIGHT. UNLESS OTHERWISE NOTED THESE PRICES ARE SUBJECT TO ADJUSTMENT IN THE EVENT OF CHANGES, AND GOODS WILL BE INVOICED AT PRICES PREVAILING AT THE TIME OF SHIPMENT.

ORDERS COVERING SPECIAL GOODS ARE NOT SUBJECT TO CANCELLATION, NOR CAN SPECIAL GOODS BE RETURNED FOR CREDIT.
LIABILITY IN THE CASE OF DEFECTIVE GOODS IS LIMITED BY THE MANUFACTURER'S WARRANTY TO THE VALUE OF SUCH DEFECTIVE GOODS ONLY.
NO LIABILITY CAN BE ACCEPTED FOR DELAYS OR NON-DELIVERY DUE TO ACCIDENTS, STRIKES, FIRES, OR OTHER CAUSES BEYOND OUR CONTROL.

FLECK BROS. LIMITED
ENVIRONMENTAL DIV.
F. W. (JOHN) JOHNSON

SCHEDULE I - SCHEDULE OF PRICES

IGNITION BURNER

1.	Ignition burner as described in the specification, FOB point of sale	$ 11,245.00
2.	Canadian Customs Duty _____ % of $ __________	$ NIL
3.	Transportation to site	$ INCLUDED
	TOTAL	$ 11,245.00

FLECK BROS. LIMITED
ENVIRONMENTAL PRODUCTS DIV.
110 ALEXANDER ST.,
VANCOUVER, B.C. V6A 1B6
Phone (604) 681-4326 TLX No. 04-53205

F. W. (JOHN) JOHNSON
ENVIRONMENTAL DIVISION

SCHEDULE II - TECHNICAL DATA

IGNITION BURNER

1.0 SPECIFICATIONS

Manufacturer's Name: PYRONICS INC.

Vendor's Name: FLECK BROS.

Model and Type: N.M. 1501

Flame length: 24" 609.6 mm

Combustion air pressure required

- Normal: 13.6" WC 3.38 kPag
- Maximum: 17.0" WC 4.23 kPag

Mounting flange size: 13" O/D 330.2 mm

Weight of burner: 60 LB. 27.2 kg

Weight of valve assembly: 60 LB. 27.2 kg

Weight of control panel: 40 LB. 18.14 kg

Dimensions of control panel: 16" X 20" 406.4x508 mm

Control power requirements: 250 VA 115 V 1 phases

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order: 1 1/2 - 2 months

FLECK BROS. LIMITED
ENVIRONMENTAL PRODUCTS DIV.
110 ALEXANDER ST.,
VANCOUVER, B.C. V6A 1B6
Phone (604) 681-4328 TLX No. 04-53205

F. W. (JOHN) JOHNSON
ENVIRONMENTAL DIVISION

131-1

TRECAN

The Canadian Combustion Company

TRECAN LIMITED
4540 DIXIE ROAD
MISSISSAUGA
ONTARIO
L4W 1N2
(416) 625-4030
TELEX 06-961261

integ
NOV 14 1983
CIRC. DATE

Integ
1155 West Pender St.
Vancouver, B.C.
V6E 2P4

Attn: Mr. G.R. Cooper, P. Eng.
Project Manager

Re: Ignition burner for fluidized bed combuster.
- your file 0243 - El

Gentlemen;

We have your enquiry dated Oct. 21, 1983 which we received Nov. 1, 1983, and we are pleased to up - date our budget estimate in accordance with the specifications attached to your letter.

The increased combustion air pressure and furnace pressure make it necessary for us to enclose our burner head in a pressure casing. Another change to our original assumptions lies in the description of the possible operation at times other than start - up. This makes it necessary to add a constant differential pressure valve to maintain the differential between furnace pressure and combustion air pressure.

The above additions have been incorporated in our price. Our supply would include the following:

1 HV - 320 gas burner, with special combustion chamber guard and pressure casing.
1 Pilot set with pilot gas train.
1 Gas Train with necessary solenoid shut - off valves, pressure switches, firing cock and pressure guage.
1 Control valve assembly including dilution valve, combustion air valve and gas valve, complete with operating airhead and positioner. The assembly would be controlled manually through a manual loading station.
1 Low fire microswitch.
1 Low combustion air pressure switch.
1 Fisher differential pressure regulator, air operated.
1 Differential air pressure guage.
1 Flame failure and burner management system, including - AV scanner, relay, amplifier etc. in accordance with the specifications.
1 Local panel, complete with indicating lights, push buttons, relays, switches and incorporating the manual loading station and specified alarms.

Price for all the above, including two days start - up assistance, $ 22,100.00 job Mississauga, sales tax not included.
If we can be of futher assistance please call on us.

Yours very truly,

R. Parker, P. Eng.
Sales Engineer

SCHEDULE I - SCHEDULE OF PRICES

IGNITION BURNER

1.	Ignition burner as described in the specification, FOB point of sale	$ 22,100.00
2.	Canadian Customs Duty _____ % of $ __________	$ --------
3.	Transportation to site	$ 125.00
	TOTAL	$ 22,225.00

SCHEDULE II - TECHNICAL DATA

IGNITION BURNER

1.0 SPECIFICATIONS

Manufacturer's Name	Trecan Ltd.	
Vendor's Name	Trecan Ltd.	
Model and Type	HV - 320	
Flame length	300	mm
Combustion air pressure required		
- Normal	Differential 6	kPag
- Maximum	70	kPag
Mounting flange size	308	mm
Weight of burner	45	kg
Weight of valve assembly	90	kg
Weight of control panel	96	kg
Dimensions of control panel	600 x 770 x 257	mm
Control power requirements	____ VA ____ V ____	phases

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order FOUR months

141-1
BED DRAIN COOLER

141-1

BIDDER'S LIST

BED DRAIN COOLER (141-1)

Bethlehem Corporation
25 & Lenox Steets
Easton, PA
18042

Control and Metering Ltd.
711 Kipling Ave.
Toronto, Ontario
M8Z 5G4

Attn: Mr. Chet Karpowicz

Denver Equipment Division
Joy Manufacturing Co.
235 King St. East
Kitchener, Ontario
N2G 4N6

Attn: G. Panthel

Christian Engineering
Building 411, Hunters Point
San Francisco, CA
94124

Attn: Mr. Harry Bharwani

141-1

REPLY TO: THE BETHLEHEM CORPORATION
12881 KNOTT AVENUE, SUITE 108
GARDEN GROVE, CALIFORNIA 92641
714/898-5567

BSPE Cleveland

INDEPENDENCE TOWER, ROOM 800 • 5755 GRANGER ROAD • INDEPENDENCE, OHIO 44131 • (216) 398-0300 • TLX 84-7336

December 27, 1983

integ
JAN 04 1984
GRC

Intercontinental Engineering LTD
1155 West Pender Street
Vancouver, British Columbia Canada V6E2P4

Attention: Mr. G. R. Cooper, P.E.
Project Manager

Subject: CANMET Energy Research Laboratories

Reference: File 0243-E1

Gentlemen:

We are pleased to attach subject budget proposal in substantial accordance with your specifications and our telephoned quotation of November 16, 1983.

The Thermal Disc Calcine Cooler has been used successfully over the past 15 years for cooling a variety of materials treated at temperatures in excess of 1000°F and having abrasion characteristics.

The cooler is designed without using a trough jacket. Liberal clearances are provided so that the material processed provides internal insulation to maintain the structural integrity of the equipment.

Drawing *7057-60-473-01 is enclosed for dimensions only. The cooler itself can be demounted from the base to accommodate the primary combustion apparatus. The drive can be mounted under, over or in line with the cooler body. Maximum inclination should not exceed 15° if the angle of repose of the solids exceeds 60° at room temperature.

The data sheets are as complete as possible since we have not been successful in obtaining full information from the drive manufacturer.

We recognize the preliminary nature of your offering and would expect to have the opportunity to submit a more complete proposal at a later date.

Very truly yours,
THE BETHLEHEM CORPORATION

N. J. Stevens /lkr

N. J. Stevens
Product Manager

* NOTE - INLET 4'-11 FROM GROUND
(TOO HIGH)
STD. DRUM FITS BENEATH

NJS/lkr
attachments

the Bethlehem Corporation
EASTON, PENNSYLVANIA 18042

A BUDGET PROPOSAL

TO

INTERCONTINENTAL ENGINEERING LTD
1155 WEST PENDER STREET
VANCOUVER, BRITISH COLUMBIA, CANADA V6E2P4

FOR

THERMAL DISC ASH COOLER
MODEL 10I5S43
FLUIDIZED BED SOLIDS

CANNET ENERGY RESEARCH LABORATORIES
OTTAWA, ONTARIO, CANADA

BUDGET PURCHASE PRICE

ONE (1) MODEL 10I5S43 Disc Cooler - - - - - - - - - - - - - - - - - - $29,800. U.S.

Price is F.O.B. Shops - San Francisco, California.

TAXES

With respect to any federal, provincial or local sales, use or other taxes applicable to this transaction and imposed on or required to be collected by Seller and not stated as included in sales price, such taxes or the amount thereof shall be added to the sales price for Purchaser's account. Import duty, if applicable, will be paid by Purchaser.

ACCEPTANCE

This offer is valid through the period ending March 31, 1984.

ESTIMATED SHIPPING WEIGHT - 1,600 LBS.

TERMS OF PAYMENT

Twenty percent (20%) with order
Thirty percent (30%) at 50 percent point of manufacturing completion
Thirty percent (30%) at shop completion
Twenty percent (20%) thirty days after shipment from factory

DESCRIPTION OF EQUIPMENT

General

The Thermal Disc Cooler is an indirect type solids cooler consisting of rotating hollow discs mounted on tubular shafts enclosed in a fabricated trough.

Solids discharging from the vertical reactor are cooled by indirect contact with cooling water which is force circulated within the discs and hollow center shaft. Material is conveyed from the feed end to the discharge end by differential friction between the rotating discs and the material. An adjustable weir is provided at the discharge end to allow control of retention time and product temperature.

The rotating intermeshed discs mechanically agitate the material to be cooled, as well as provide a conveying means. Agitation is assisted by radial clips mounted on the disc surfaces. The added agitation means enable the Thermal Disc Cooler to yield a product of relatively constant temperature despite fluctuations in feed rate or inlet temperature.

Water is used to cool the hollow discs which are welded to the parallel rotating shafts. The end of each shaft is equipped with a stationary joint to allow for introduction and discharge of the cooling water.

An integrated drive assembly is provided to rotate the disc assemblies. The drive consists of a motor coupled to a speed reducer by means of pulleys and belt. The reducer slow speed shaft is connected by chain and sprocket to a shaft on the cooler. Chain and sprockets connect the additional shafts to each drive section. D.C. variable speed motors are included.

DESCRIPTION OF EQUIPMENT - continued

Hot Calcine Cooling Application

Applications in this service utilize the basic principles described above, however, experience has assisted in revising the design to accommodate the hostile environment by high temperature, abrasiveness and fluidity.

Cyclic thermal stresses at the inlet are imposed on indirect type coolers when calcines enter above 1200°F. Cyclic stresses cause layer separation in the metal flights or disc plates.

Due to the high flux rates, we maintain flow rates equivalent to a Reynolds number above 150,000. The temperature drop across the wall of the shock drum is less than 15°F above the bulk cooling water temperature.

In high temperature service, troughs are never water jacketed. Deep clearances between the trough bottom and disc periphery fill with ash and become an immovable dead bed.

Trough covers are internally insulated with spun clay insulation to provide structural stability.

Abrasion characteristics of the ash present a design consideration. The abrasiveness usually increases with decreasing temperature. The wear points on the rotating discs are restricted to the periphery. We provide a replaceable wear ring on the periphery of each disc to prevent erosion from occurring in the weld. Usual life of the wear rings is 10 to 15,000 operating hours. Rarely are all wear rings replaced at the same time. Replacement rings are supplied as semicircles to facilitate installation. In most cases, the new wear rings are installed over the top of the worn rings.

Replaceable wear sleeves are also desirable when handling finely divided abrasive materials.

SPECIFICATIONS

Bethlehem furnishes equipment in accordance with its own engineering and manufacturing standards as outlined in the proposal and as will be covered by final, approved, certified drawings. The equipment may not be in strict compliance with the plans, specifications or addenda due to minor deviations; however, the equipment will meet the general intent of the mechanical specifications of these documents.

INCIDENTAL AND CONSEQUENTIAL DAMAGES

Bethlehem shall not be liable to the Buyer for any consequential or incidental losses or damages for any reason whatsoever, whether based on contract, tort, warranty, negligence, indemnity, strict liability or otherwise.

TERMS AND CONDITIONS

1. General Terms

The Seller's Proposal is subject to change or withdrawal without notice and shall in no event remain effective for a period to exceed thirty (30) days from the date hereof.

Prices are subject to change by Seller to conform to those in effect at the time of placement of order and/or to reflect changes which may occur in tariff freight rates (if used in determining delivered prices). Prices do not include sales, use, privilege, excise or other taxes or custom duties which, if applicable, shall be the sole liability of and shall be paid by the Buyer. Unless otherwise specified, payment shall be made in cash in United States funds acceptable at par in Philadelphia, Penna., U.S.A., and delivery shall be f.o.b. point of shipment. Buyer assumes risk of and Seller shall not be liable for any loss or damage after such delivery but Seller will cooperate with the Buyer in prosecution of claims against the carrier. Buyer shall be liable to Seller for any unpaid balance of purchase price, irrespective of any loss or damage after such delivery.

No acceptance of Company's proposal by Purchaser and no Purchase Order for any of the equipment offered thereby shall create any contract between Company and Purchaser or be binding in any way on Company until such acceptance or Purchase Order is approved in writing by authorized personnel at its principal offices in Bethlehem, Pennsylvania.

Net payment in full on all invoices is due thirty (30) days after shipment unless otherwise stated. Pro-rata payments shall be made for partial shipments. In the event that the total price exceeds Fifty Thousand Dollars ($50,000.00), progress payments shall be due and payable prior to shipment under the following schedule:

Twenty percent (20%) payment shall be submitted with the order;

Thirty percent (30%) payment shall be due and payable on notice from Seller that approximately one-half of its cost of manufacture under the order has been paid or incurred;

Thirty percent (30%) of payment shall be due and payable on notice from Seller that the order has been completed and ready for final testing;

Balance of payment shall be due and payable thirty (30) days after shipment. Any account unpaid after final shipment is subject to a service charge of one-half percent (½%) per month on the unpaid balance.

If delivery is prevented or postponed by reason of any cause set forth specifically or by implication in paragraph (4), then all dates of payment related to delivery shall relate to the date of completion of manufacture, provided, however, that if the Seller shall be delayed in starting manufacture, shipment or other phase of the agreement by action or inaction of Buyer, payment shall be due as if the Seller had shipped the equipment as called for in the agreement. Letters of credit or other credit instruments established to provide payment for the goods or equipment specified in this proposal shall make provision for payment as set forth above where delivery is prevented or postponed under such circumstances. Storage of such machinery shall be at the Buyer's expense and risk.

2. Warranty

Seller warrants that the goods, equipment or machinery manufactured by it are free of defects of material and workmanship and are merchantable within the meaning of the Pennsylvania Uniform Commercial Code, for a period of one (1) year after date of shipment under normal use and service. Seller assumes no responsibility for the effects of corrosion or erosion.

Seller further warrants that the use or sale of the goods, equipment or machinery delivered hereunder does not infringe any valid claim of any United States patent covering the goods. Seller shall indemnify and save Buyer harmless against loss for infringement of any valid United States patent claiming the goods, equipment or machinery. In the event that any suit for such infringement is brought, Seller may be represented therein by counsel of its own selection and Buyer shall make no settlement of any claim or suit relating to such infringement without Seller's consent in writing.

SELLER MAKES NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE AND THE WARRANTY STATED HEREIN IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OTHERWISE, and all other liabilities and obligation on Seller's part, and Seller expressly denies the right of any other person to incur or assume for it any other liability in connection with the sale of goods by it.

This Warranty is extended to the original purchaser only.

3. Liability

Seller shall repair or replace, f.o.b. factory, any part or parts of the goods, equipment or machinery manufactured by it, found upon inspection by it to be of defective workmanship or material, or at its option return the purchase price of such part or parts provided such part or parts are (a) returned freight prepaid to such factory as Seller may designate, with Seller's prior written approval, within a reasonable time not exceeding one (1) year from date of installation or eighteen (18) months from the date of shipment, whichever is sooner, and (b) are still owned and possessed by the Buyer. Seller's warranty with respect to goods, equipment or machinery manufactured by others will be the same as that of the manufacturer.

Seller's liability with respect to the goods, equipment or machinery sold hereunder is expressly limited to the remedies set forth in these Terms and Conditions, such remedies are exclusive, and Seller shall under no circumstances be liable for incidental or consequential damages. Any cancellation or rescission by Buyer shall constitute a discharge of any claim by Buyer for damages relating to this transaction.

4. Delivery

The time for shipment stated herein is approximate and is estimated from the date of receipt of order with complete manufacturing information and approval of drawings as may be necessary. Seller shall not be liable for any loss or damage for delay or non-delivery or other default in performance hereunder when such delay or default directly or indirectly results from or is contributed to by circumstances beyond the control of the Seller. Such circumstances include, but are not limited to, an act of God; war or national emergency; fire; flood; riot; explosion; inability to obtain necessary materials: or any labor dispute. difficulty or practice, however caused; and export, import, dollar exchange or other governmental regulations or restrictions. Buyer may not cancel for such circumstances but performance may be suspended for a reasonable period of time. Seller shall in no event be liable for any special, indirect or consequential damages, arising from delay irrespective of the reason therefor, and receipt by Buyer shall constitute acceptance of delivery and waiver of any claims due to delay.

5. Changes

Seller reserves the right to change or modify the design and construction of its goods, equipment or machinery and to substitute other suitable material. After acceptance, Buyer's order will not be subject to modification by Buyer except with Seller's consent and upon terms which will require the Buyer to pay the full contract price of completed articles and all loss and damage with respect to the portion of Buyer's order not completed.

6. Drawings

If drawings are furnished with this proposal, they are submitted only to show the general style, arrangement and approximate dimensions of the goods, equipment or machinery offered. No work is to be based on proposal drawings. Foundation or assembly drawings certified by Seller will be furnished when required by and after acceptance of this proposal. Such foundation drawings will show location for foundation bolts and dimension recommended for soil conditions that are satisfactory. All drawings remain the property of Seller and must be returned if Seller so requests. Their reproduction in whole or in part is forbidden. Seller does not supply detail or shop working drawings of its goods, equipment or machinery. General assembly, parts list and only those general drawings necessary for erection will be furnished.

7. Cancellation

Buyer may cancel this order only upon written notice and payment to Seller of reasonable and proper cancellation charges set forth herein, to be determined by Seller. All items completed at the time of receipt of written cancellation notice will be shipped and invoiced at the contract price. Work on the balance of the order will be stopped as promptly as reasonably possible and Seller shall be reimbursed for all actual expenditures, commitments, liabilities and costs, determined in accordance with good accounting practice, made or incurred with respect to such incompleted items, plus a profit of twenty percent (20%) on such costs. Any items which Seller can use economically to fill other active orders will be restocked at a twenty percent (20%) handling charge.

Seller shall have the right to require that Buyer post adequate security for any and all payments due if a good faith doubt arises as to Buyer's ability to make prompt payment. Seller shall have the absolute right to cancel and refuse to complete this order: (1) if at any time all terms and conditions governing this order (including any requirement of progress payments) are not strictly complied with by the Buyer, (2) if at any time Buyer becomes bankrupt or insolvent, or (3) if Buyer fails to post security as required above within thirty (30) days after Seller has requested the same. In the event of such cancellation, Seller shall have the right to indemnification for any or all costs incurred to the date of cancellation in performing the order (including the cost of any engineering studies and/or special patterns) and for the loss of profit resulting from such cancellation, which shall be deemed to be twenty percent (20%) of all costs subject to indemnification. The Seller shall have the right, at its option, to waive its rights to indemnification with regard to any item scheduled for completion within sixty (60) days following the date of cancellation and to complete such items and request full payment for the same. Seller shall have no responsibility or liability to the Buyer except for the return of any excess of Buyer's partial payments on the order less the foregoing costs and loss of profit.

8. Insurance

Buyer shall bear all risk of loss or of damage to goods, equipment or machinery from the time of acceptance of shipment by transporting carrier and shall provide and maintain adequate insurance against loss or damage by fire or other causes to such goods, equipment or machinery during the time between delivery and final payment in an amount fully protecting Seller. Loss or damage by fire or other causes within such period shall not relieve Buyer from its obligation to pay the purchase price in full.

9. Security Agreement and Title

Buyer hereby grants to Seller and Seller hereby reserves a purchase money security interest in the goods or equipment covered by this order to secure payment of the purchase price, service charge and all costs and expenses incurred by the Seller in the collection of the same. The collateral of this security agreement is the goods, machinery or equipment and all additions and accessions thereto and the proceeds thereof. In addition to all rights given to Seller by this security agreement, Seller shall have all rights and remedies of a secured party under the Pennsylvania Uniform Commercial Code and any other applicable law. Until the balance is paid in full, title to the goods or equipment shall remain in Seller.

In the event of failure of the Buyer to make any payments when due under this agreement, or if the Buyer has made a misrepresentation or a misstatement in connection with this security agreement, or fails to comply with or perform any of its obligations hereunder, or to observe or perform any of the conditions herein contained, or if the Buyer shall commit an act of bankruptcy, or shall be adjudicated a bankrupt, or if a receiver shall be appointed for the business or assets of the Buyer, or if the goods or equipment are in danger of loss or abuse, then in any such event, Seller may exercise its rights of enforcement under the Pennsylvania Uniform Commercial Code. In addition to such rights, and at the option of Seller, Seller may declare the entire unpaid portion of the purchase price immediately due and payable and this agreement terminated, and may immediately enter any premises where it has reason to believe the goods or equipment may be found, and take possession of and remove said goods and equipment with or without legal process, and Seller may retain all payments made up to the time of such removal, or so much thereof as may be permitted by law, as liquidated damages, and as rental and depreciation, and as compensation for all expenses incurred by Seller in retaking the goods and machinery; provided, however, that nothing herein shall preclude Seller from pursuing any legal remedy for the recovery of any other sum to which it may be entitled for the breach of this agreement by the Buyer.

10. Assignment

Buyer's order, if accepted by Seller, will not be assignable by Buyer without Seller's consent in writing, and no assignment by Buyer with or without consent shall terminate Buyer's liability to Seller or require Seller to look to Buyer's assignee for payment.

11. Entire Agreement

The terms hereof, including those written within the body of this document, shall constitute the entire agreement between the Buyer and Seller, and no change or modification of this agreement shall be binding on the Seller unless such change or modification shall be in a writing executed by an authorized representative of the Seller. This agreement shall be construed in accordance with the laws of the Commonwealth of Pennsylvania, U.S.A. In the event that any of the printed terms and conditions set forth above are in conflict with or inconsistent with the terms typewritten or handwritten within this document, then the typewritten or handwritten terms shall govern to the extent necessary to remedy the conflict or inconsistency, but the printed terms and any portion thereof shall govern in all other respects.

Seller's written acceptance of Buyer's regular purchase order shall be with the mutual understanding that all specifications, terms and conditions hereof are a part thereof with the same effect, as though signed by both parties hereto and shall prevail over any inconsistent provisions of Buyer's purchase order. Except as may be otherwise agreed in writing, this agreement shall apply to, inure to the benefit of and bind the heirs, successors, executors, administrators and assigns of the parties hereto.

12. Indemnity

Buyer shall use and require its employees to use all safety devices, guards, and proper safe operating procedures as set forth in manuals and instruction sheets furnished by Seller. Buyer shall not remove or modify any such device or guard or warning sign. Buyer shall not permit any person other than required by operating personnel to remain within ten (10) feet of any machine or accessory manufactured by the Seller during the operation thereof. If Buyer fails to strictly observe each and every one of the obligations set forth in this contract with regard to any of Seller's products, Buyer agrees to indemnify and save Seller harmless from any liability or obligation incurred by Seller to persons injured directly or indirectly in connection with the operation of such products.

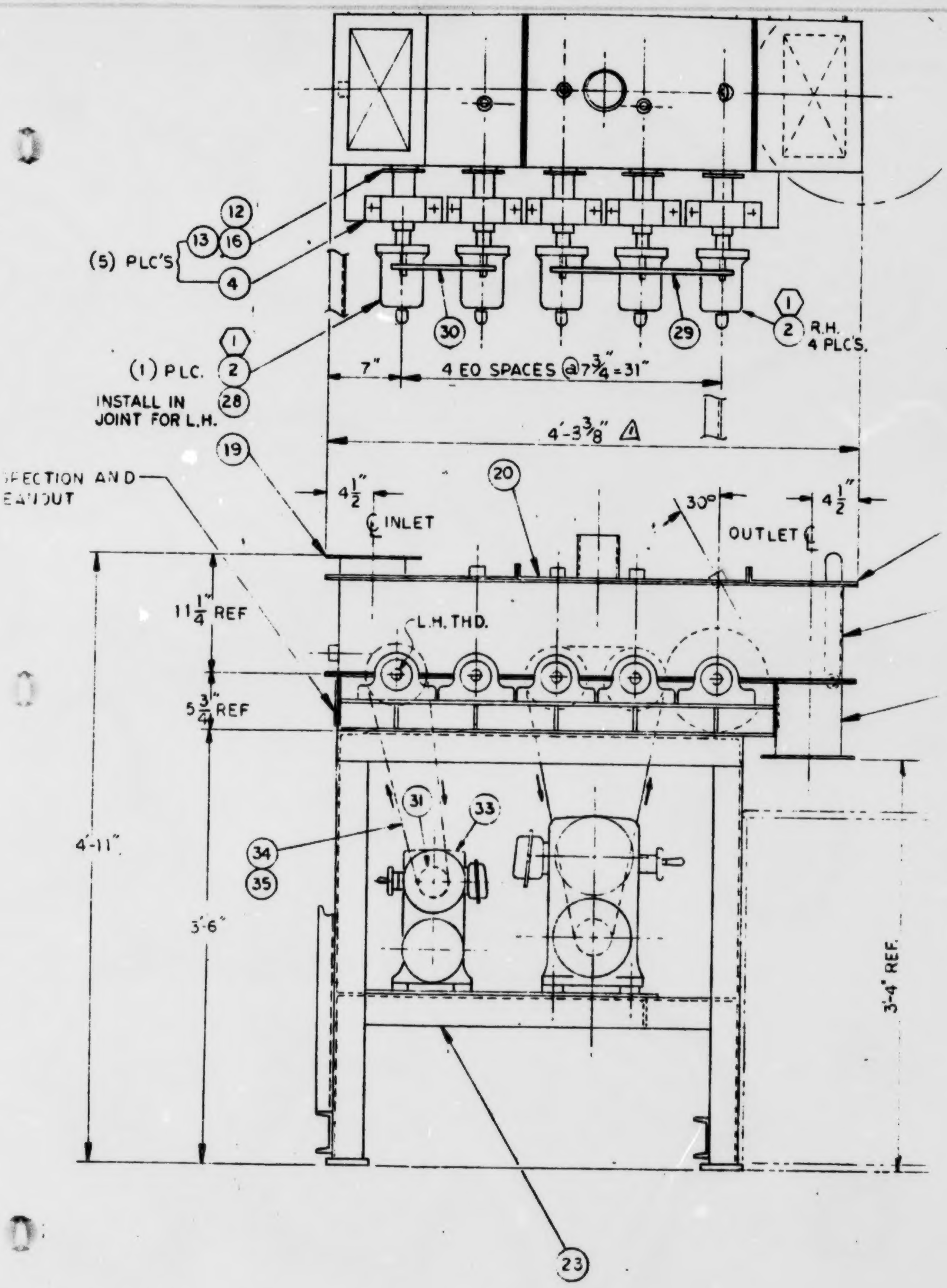
ACKNOWLEDGMENT

If the goods, equipment or machinery described herein is covered by Seller's Proposal Form, executed by Buyer and accepted by Seller, this will serve merely to acknowledge Seller's acceptance of that proposal and to effect delivery to the executed copy of it which is attached hereto. If Seller has unconditionally accepted in writing purchase order of Buyer covering the equipment described herein or formally agreed upon terms and conditions to be used on a continuing basis, this will serve merely as an order acknowledgment.

process equipment division

THE
BETHLEHEM
CORPORATION ESTABLISHED 1856
25TH & LENNOX STREETS
P. O. BOX 348
EASTON, PA. 18042

Form TC1-7/71


12
13
16
(5) PLC'S
4
1
2
R.H.
4 PLC'S.
30
29
(1) PLC.
2
INSTALL IN
JOINT FOR L.H.
28
7"
4 EQ SPACES @ 7 3/4" = 31"
4'-3 3/8"
1
19
SECTION AND
CLEANOUT
20
4 1/2"
℄ INLET
30°
4 1/2"
OUTLET ℄
11 1/4" REF
L.H. THD.
5 3/4" REF
4'-11"
3'-6"
31
33
34
35
3'-4" REF.
23

EXCERPT FROM DRAWING 7057-60-4

SCHEDULE I - SCHEDULE OF PRICES

BED DRAIN COOLER

1.	One (1) ash cooler as described in the specification, FOB point of sale	$ 29,800 U. S.
2. *	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ 1,500
	TOTAL	$ __________

* INITIAL CONTACT WITH CANADIAN CONSULATE INDICATES EQUIPMENT MAY ENTER COUNTRY DUTY FREE.

SCHEDULE II - TECHNICAL DATA

BED DRAIN COOLER

1.0 SPECIFICATIONS

Manufacturer's Name	THE BETHLEHEM CORPORATION	
Vendor's Name	SAME	
Model and Type	THERMAL DISC TYPE 1015S43	
Ash cooler overall dimensions	L W H 1320 x 1066 x 1525	mm
Unit total weight	720	kg
Screw diameter	254	mm
Flight material	AISI #304 S.S.	
Flight thickness	4.75	mm
Screw pitch	DNA	mm
Screw shaft diamter	54	mm
Screw bearings (type)	DODGE-PILLOW BLOCK	
Trough material	AISI #304 S.S.	
Trough material thickness	4.75	mm
Trough jacket thickness	NO JACKET REQ'D.	mm
Connection sizes		
- inlet	75	mm
- outlet	75	mm
- water inlet	1"	mm
- water outlet	1"	mm
Variable speed drive		
- Type	IMPAK PLUS	
- Manufacturer	RELIANCE ELECTRIC CO.	

- Model No.	LTR	
- Speed ratio		
- Power rating		kW
- Supply voltage	120 V 3	phase
Motor data		
- Enclosure type	LTR	
- Manufacturer		
- Power output		kW
- Speed		rpm
- Temperature rise		°C
- Frame size		
Unit output max.	0.045	kg/s
Unit output min.	0.002	kg/s
Water usage @ design conditions	0.233	kg/s
Max. water usage	0.283	kg/s
Max. continuous operating temp.	66	°C

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture
and shipment from receipt of order 4 months

141-1

JOY MANUFACTURING COMPANY (CANADA) LIMITED
DENVER DIVISION
235 KING ST. E., KITCHENER, ONT. N2G 4N6 · (519) 578-6400 · TELEX: 069-55324

integ
NOV 21 1983
GRC

November 18, 1983

Intercontinental Engineering Ltd.
1155 West Pender Street
Vancouver, British Columbia
V6E 2P4

Attention: G. R. Cooper
Project Manager

Subject: Energy Mines and Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Equipment Cost Estimate
Your Ref: File 0243-E1
Our Ref: 83/3104

Gentlemen

Thank you for the subject inquiry for a Holoflite ash cooler.

Accordingly, please find attached our proposal including your completed data sheets and price quotation.

Our bid is made on behalf of our U.S. parent company, as the unit is not manufactured by us in Canada. Recent changes by one of our competitors may result in the unit entering Canada duty free, on the basis that it may be of a class or kind not made in Canada. A further review is required.

The price quoted is firm through delivery before December 31, 1984 and valid for your acceptance before March 31, 1984.

We trust our proposal to be satisfactory for your requirements. However, please do not hesitate to contact us if we may be of further assistance.

Yours very truly

JOY Manufacturing Company (Canada) Limited
DENVER DIVISION

G. Panthel
Manager -Marketing

FLOTATION MACHINES • FILTERS • AGITATORS • THICKENERS • SAMPLERS

c.c. P.J. Hannah & Associates
5350 Imperial St., Burnaby, B.C. V5J 1E6

JOY MANUFACTURING COMPANY
DENVER EQUIPMENT DIVISION
235 King Street East, Kitchener
N2G 4N6
Telephone (519) 578-6400 Tlx 069-55324

PROPOSAL FOR HOLO-FLITE® PROCESSOR

PROPOSAL NO. : 83/3104 **DATED** : November 18, 1983
ITEM NO. :

CLIENT : Intercontinental Engineering **CLIENT REF.**: 0243-E1

FINAL LOCATION: E.M.&R., Ottawa

JOY **JOY MANUFACTURING CO., DENVER EQUIPMENT DIVISION (herein called JOY) proposes to furnish f.o.b. Colorado Springs, Colorado, Holo-Flite® Processor equipment specified herein, in accordance with the attached General Conditions of Sale.**

PROCESS OPERATING CONDITIONS

Material Handled: Spent Limestone Sorbent & Combustor Bottom Ash
Operation: Cooling
Feed:
Rate: 325 **lb./hr. Bulk Density:** 85 **lb./cu.ft. Material Flow:** 3.8 **CFH**
Temperature: 2,012 **°F Moisture or Volatile Content:** 0 **%**
Discharge:
Rate: 325 **lb./hr. Bulk Density:** 85 **lb./cu.ft. Material Flow:** 3.8 **CFH**
Temperature: 302 **°F Moisture or Volatile Content:** 0 **% (of feed rate)**
Specific Heat: .3 **Solids: BTU/lb.-°F Volatiles:** - **BTU/lb.-°F**
Latent Heat of Evaporation: BTU/lb. LMTD: °F MTD: °F
Total Calculated Heat Load: 167,000 **BTU/hr.**
Screen Analysis: -¼" plus infrequent -2" lumps
HEAT EXCHANGE AGENT: water
Rate: 8 U.S.G.P.M.
Temperature: Initial: 84 **°F Supply Pressure:** 15 **psig (screws)**
Final: 151 **°F** 15 **psig (jacket)**

These data are warranted by CLIENT to be complete and correct.

HOLO-FLITE® EQUIPMENT

TYPE: 1 S 5 7 10 4
Pitch of the Screws (inches)
Nominal length of the Screws (feet)
Nominal diameter of the Screws (inches)
No. of Screws per UNIT **(S=Single; D=Double; Q=Quadruple)**
Total number of UNITS

Each tier to conform substantially to Drawing:

PRICE

U.S. $34,662. F.O.B. Colorado Springs, Colorado, U.S.A.

WEIGHT SHIPMENT

Approximate shipping weight: 1,685 **lbs./**UNIT 1,685 **lbs. total** UNITS

If required, preliminary General Arrangement Drawings will be scheduled for mailing ______ weeks after written acceptance by JOY of written authorization from CLIENT to proceed with furnishing the equipment herein proposed.

Within 6 **weeks after receipt of CLIENT'S approval or request for changes, Certified General Arrangement Drawings will be mailed to CLIENT. Within** 24 **weeks after mailing of Certified Drawings, JOY will ship the equipment herein proposed.**

The foregoing schedule is contingent upon receipt by JOY of interface design requirements with the CLIENT'S authorization to proceed.

PROPOSAL PREPARED BY G. Panthel G Panthel

(signed)

5.44011

Joy Manufacturing Co., Denver Equipment Division
DATE: November 18, 1983
PROPOSAL NO.: 83/3104
ITEM NO. :

SPECIFICATIONS
PART ONE
HOLO-FLITE® PROCESSOR

JOY WILL PROVIDE THE FOLLOWING WITH DELIVERED EQUIPMENT:

DRAWING AND OPERATING INSTRUCTIONS

1. General Arrangement Drawings, including inlet and outlet templates and anchor bolt plan for CLIENT'S foundations.
   a. Approval Dwgs.: _______No. Prints 2 No. Reproducibles
   b. Certified Dwgs.: _______No. Prints 2 No. Reproducibles
2. Recommended Spare Parts List: 6 No. Required.
3. Operating Instructions, Parts Lists and Diagrams for operating and maintaining the equipment and its accessories: 6 No. Required.

NOTE: All drawings and operating instructions to be in English with U.S.A. standards.

HOLO-FLITE® EQUIPMENT

TYPE: S710-4 HOF ___DED ___GED

SCREWS

Screw Heat Transfer Area: 21.6 sq. ft./UNIT sq. ft. total UNITS
Product Contacting Parts: 304 S.S.
Flight Thickness: 3/16 Screw Finish: Std.
Maximum Operating: Pressure: 11 psig Temperature: 151 °F
ASME Code Construction and National Board Stamp* ☒ Yes ☐ No
Special Features: Mixing Lugs

ROTARY JOINTS

Make: Johnson Size: 1 Inches

TROUGH

Net Trough Internal Volume: 2.6 cu. ft./UNIT cu. ft. total UNITS
Product Contacting Parts: 304 S.S.
Operating Pressure: 15 p.s.i. Trough Finish: Std.
Shaft Seals: Standard Rings Material:
Special Features: Feed end jacketed

TROUGH JACKET

Jacket Heat Transfer Area: ** sq. ft./UNIT sq. ft. total UNITS
☐ Supplied ☐ Omitted Maximum Operating: Pressure: 15 psig Temp.: 151 °F
Material: Carbon Steel Finish: ☐ Sand Blast ☐ Paint ☐ Other
ASME Code Construction and National Board Stamp* ☒ Yes ☐ No

TROUGH COVER

Type: ☒ Flat ☐ Vapor Dome
Material of Construction: 304 S.S. 1 No. 3 Size Vapor Ports
Fastenings: Bolted 1 No. 3 Size Inspection Ports
Special Features:

DRIVE ASSEMBLY

Furnished by: JOY Drive Position:
No. Motors Required: Type: ☐ Open ☒ Totally Enclosed
☐ Explosion Proof
H.P.: ½ 230 Volts 60 Hertz 1 X Phase
☐ Constant Speed ☒ Variable Speed
Screw Speed .3 - 5.5 R.P.M.

OTHER FEATURES

_____No. Sets (4 hoses per joint/set) Flexible Hoses
Automatic Lubrication System: ☐ Supplied ☒ Omitted

---

* ASME Code Construction and/or National Board Stamp is required in some localities or States, or by the CLIENT'S Insurance Underwriter, when steam above 15 psig or hot heat transfer fluids are used as Heating Agents. The CLIENT must verify such requirements.

** Not considered in sizing. "U" factor only based on screw area.

SPECIFICATIONS
PART TWO

HOLO-FLITE® PROCESSOR

TO BE PROVIDED BY CLIENT:

CLIENT will install equipment as specified in Specifications Part One, will furnish and install equipment as specified in Specifications Part Two, and will supply operating conditions and operating requirements, as specified herein, together with such auxiliaries and appurtenances to make equipment complete and operable.

NOTE: Design calculations based upon requirements as supplied by CLIENT are exact as is feasible. However, variations in the quantity, chemical composition, thermal conductivity, and the physical state of the material, as well as variations in the temperature and quantity of the heat transfer agent being circulated, will affect the outlet conditions. Wide fluctuations in ambient temperatures may also affect operation on some applications.

FOUNDATIONS

Foundations and/or support structure together with necessary anchor bolts and other fasteners, designed and constructed to conform with JOY Anchor Bolt Plan, but CLIENT is to assume full responsibility for their ability to support properly the loads placed upon them.

CONNECTIONS

The necessary final connections between the equipment furnished by JOY and the equipment to be furnished by CLIENT such as:

(a) All electrical wiring and connections.
(b) Connections to all bolting flanges including necessary fittings, valves, bolts, nuts, etc., as required.
(c) Water, sewer connections where required with suitable traps and valves.
(d) Flexible hoses between the Rotary Joints and the Heat Agent supply piping.

MATERIAL HANDLING

Equipment to convey material to and from the Processor at a uniform rate. Most efficient heat transfer may be obtained only by keeping the syncro screws completely covered with the material at all times.

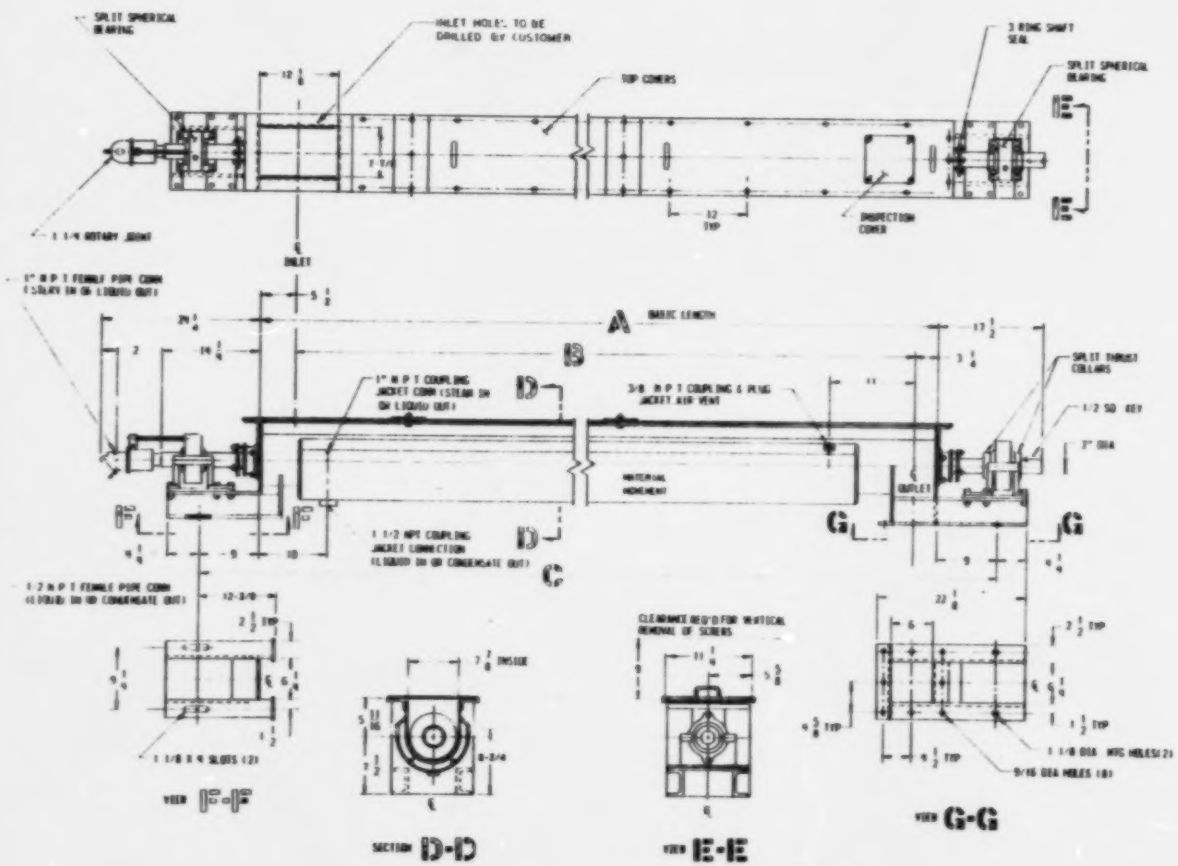
HEAT TRANSFER MEDIUM

Neutral medium free from sediments or material which will cause excessive scale formation or corrosion.

SKETCH OF DESIRED LAYOUT

The CLIENT shall supply with the Purchase Order a sketch of the equipment, indicating the desired location of the drive (see dwg. A-80368). Positions 1 and 2 with drive base level with Holo-Flite® base are standard. When cooling materials above about 400°F or when the equipment is on an incline, JOY recommends to locate the drive at the discharge end. Holo-Flite® Processors using steam as heat transfer agent if installed on an incline MUST have the drive at the discharge end.

When vapor and inspection ports are furnished the desired location of such ports should be marked on dwg. B-80617.


SPLIT SPHERICAL BEARING
INLET HOLES TO BE DRILLED BY CUSTOMER
TOP COVERS
3 RING SHAFT SEAL
SPLIT SPHERICAL BEARING
1 1/4 ROTARY JOINT
INLET
12 TYP
INSPECTION COVER
1" N P T FEMALE PIPE CONN (STEAM IN OR LIQUID OUT)
A BASIC LENGTH
B
C
1" N P T COUPLING JACKET CONN (STEAM IN OR LIQUID OUT)
3/8 N P T COUPLING & PLUG JACKET AIR VENT
SPLIT THRUST COLLARS
1/2 SQ KEY
2" DIA
MATERIAL MOVEMENT
OUTLET
1 1/2 NPT COUPLING JACKET CONNECTION (LIQUID IN OR CONDENSATE OUT)
1/2 N P T FEMALE PIPE CONN (LIQUID IN OR CONDENSATE OUT)
1 1/8 X 4 SLOTS (2)
CLEARANCE REQ'D FOR VERTICAL REMOVAL OF SCREWS
1 1/8 DIA. MTG HOLES (2)
9/16 DIA HOLES (8)
7 7/8 INSIDE
VIEW F-F
SECTION D-D
VIEW E-E
VIEW G-G

NOMINAL SIZE	DIMENSIONS		
	A	B	C
SD710	10'-0	9'-3 1/4	11'-6
SD712	12'-0	11'-3 1/4	13'-6
SD714	14'-0	13'-3 1/4	15'-6

GENERAL NOTES

1. ALL DIMENSIONS ARE APPROXIMATE
2. SEE DWG NO B 00134 FOR SCHEMATIC FLOW OF HEAT TRANSFER MEDIA IN TROUGH JACKET
3. DRIVES MUST BE SELECTED TO CONFORM W/ PERFORMANCE REQUIREMENTS

DRIVE END DISCHARGE PROCESSOR

GENERAL OUTLINE AND
INSTALLATION DIMENSIONS
TYPE "D" SF FLAT COVER
HOLO FLITE PROCESSOR

GEORGE LYLEH

M-9669

SCHEDULE I - SCHEDULE OF PRICES

BED DRAIN COOLER

1.	One (1) ash cooler as described in the specification, FOB point of sale	$ 42,845.
2.	Canadian Customs Duty (where applicable) 11.4 % of $ 42,845.	$ 4,885.
3.	Transportation to site	$ 510.
	TOTAL	$ 48,240.

Price in Canadian funds based on currency exchange rate of U.S. $.809 per Cdn. $1.00. Currency fluctuation will be to Purchaser's account.

SCHEDULE II - TECHNICAL DATA

BED DRAIN COOLER

1.0 SPECIFICATIONS

Manufacturer's Name	DENVER Equipment Division of	
Vendor's Name	JOY Industrial Equipment Company	
Model and Type	S-71-=4	
Ash cooler overall dimensions	4,115	mm
Unit total weight	765	kg
Screw diameter	178	mm
Flight material	304 S.S.	
Flight thickness	4.76	mm
Screw pitch	102	mm
Screw shaft diamter	76 Sch 40	mm
Screw bearings (type)	Split Bronze Sleeve	
Trough material	304 S.S.	
Trough material thickness	4.76	mm
Trough jacket thickness	3.18	mm
Connection sizes		
- inlet	302 x 200	mm
- outlet	152 x 159	mm
- water inlet	½" N.P.T.	~~mm~~
- water outlet	1" N.P.T.	~~mm~~
Variable speed drive		
- Type	D.C. Adj. Speed	
- Manufacturer	Reliance	

- Model No.	Impak Plus	
- Speed ratio	20:1	
- Power rating	.37	kW
- Supply voltage	230 V 1	phase
Motor data		
- Enclosure type	TENV	
- Manufacturer	Reliance	
- Power output	.37	kW
- Speed	1,750	rpm
- Temperature rise	40	°C
- Frame size	EC 56C	
Unit output max.	.05	kg/s
Unit output min.	0	kg/s
Water usage @ design conditions	.5	kg/s
Max. water usage	.5	kg/s
Max. continuous operating temp.	1,200	°C

2.0 LIST OF ALTERNATIVES AND EXTRAS

Special notes: Intermittent feed leads to rapid expansion of material contact parts and should be avoided if possible. 2" plus lumps may lead to high wear of screw tips and trough with abrasive process materials.

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 6 months

151-1
COMBUSTOR BAYONET TUBES

151-1

152-1

FLUE GAS COOLER

152-1

BIDDER'S LIST

FLUE GAS COOLER (152-1)

Ebco Industries Ltd.
P.O. Box 94200
Richmond, B.C.
V6Y 2A5

Attention: Mr. M.R. Patterson

Ellett Copper and Brass
1575 Kingsway Avenue
Port Coquitlam, B.C.
V3C 4E5

Attention: Mr. M. Saito

Industrial Combustion and Equipment Ltd.
525 Edward VII Avenue
Dorval, Quebec
H9P 1E7

Attention: Mr. M. Walker

Isko Heat Exchangers Ltd.
2929 Halpern North
Montreal, Quebec
H4S 1R5

Attention: Mr. I. Khan

Neptune Dynamics Ltd.
1616 W. 3rd
Vancouver, B.C.
V6J 1K2

Attention: Mr. R. Green

152-1

ebco

EBCO INDUSTRIES LTD.

P.O. BOX 94200, V6Y 2A5
7851 ALDERBRIDGE WAY
RICHMOND, B.C. V6X 2A4
CANADA

TELEPHONE (604) 278-5578
TELEX 043-55619

November 1, 1983.

integ
NOV 02 1983
DATE
GRC
0243.

Intercontinental Engineering Ltd.,
1155 West Pender St.,
VANCOUVER, B. C., V6E 2P4.

Attention: Mr. G. R. Cooper, P. Eng.,
Project Manager.

Dear Mr. Cooper:

RE: Your File 0243-E1,
Energy Mines and Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Equipment Cost Estimate
Our Quotation No. 9832 - Rev. 1.

Thank you for the above referenced enquiry. We have carefully reviewed your supplied specifications and have decided that we will offer our proposal for the manufacture and supply of the flue gas to water heat exchanger, but must decline on the balance of the items specified by your enquiry for this project. We are pleased to offer as follows:-

1 - ONLY, Flue Gas to Water Heat Exchanger as specified by your completed Schedule II attached

PRICE $11,700.00

All applicable taxes extra.
F. O. B. our plant, Richmond, B. C.
Terms of Payment: Net 30 days from shipment or offer to ship.
Validity Period of Quote: 30 days.
Delivery: 12 - 14 weeks.

We sincerely hope that this proposal meets with your approval and invite your valued order.

Yours truly,
EBCO INDUSTRIES LTD.,

H.R. Patterson

Mark R. Patterson.

MRP/pgn
Encl.

FABRICATING • MACHINING • DIES • MOULDS • ENGRAVING • METAL STAMPING • PLATING • POLISHING •
HOT DIP GALVANIZING • CUSTOM MACHINERY • MACHINERY REPAIRS • STORE FIXTURES • POLE LINE HARDWARE • BUILDERS HARDWARE

SCHEDULE II - TECHNICAL DATA

FLUE GAS COOLER

1.0 SPECIFICATIONS

Manufacturer's Name	Ebco Industries Ltd.	
Vendor's Name	Ebco Industries Ltd.	
Model and Type		
Exchanger Type	Flue Gas Cooler	
Duty	382	**kW**
Water flow - maximum	1.57	**kg/s**
Water flow - design	2.46	**kg/s**
Tube side pressure drop:		
- **Operating condition** (maximum)	12.2	**kPa**
- **Design condition**	15.3	**kPa**
Shell side pressure drop:		
- **Operating condition**	1.62	**kPa**
- **Design condition** 8.16 in. wg. .29 psi	2.03	**kPa**
Design pressure:		
- **Tube side**	650	**kPa**
- **Shell side**	5	**kPa**
Test pressure:		
- **Tube side**	975	**kPa**
- **Shell side**	7.5	**kPa**
Gasket type:		
- **Flue gas nozzles**	compressed fibre	
- **Water nozzles (if applicable)**	N.A.	

Shell outside diameter	N.A.	mm
Tube diameter and wall thickness	25.4/1.65	mm
Number of tube passes	12	
Water connection sizes		
- inlet	38.1	mm
- outlet	38.1	mm
Tube withdrawal space	610	mm
Overall exchanger length	.92	m
c-c dimension - flue gas nozzles	.305	m
Material		
- Tubes	A214	
- Shell	A516 - 70	
- Baffles	-	
- Nozzle flanges	A516 - 70	
Weight:		
- dry	544	kg
- flooded	553	kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

Flanges to attach to ducting are not 150 lb. rating.

There are no shellside baffles.

The cooler is comprised of three equal sections any of which can be removed to alter the heat transfer area.

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order.	3.5	months

152-1

INDUSTRIAL COMBUSTION AND EQUIPMENT LTD.

525 EDWARD VII AVENUE
TELEX: 05821-621
DORVAL, QUEBEC H9P 1E7
TELEPHONE: (514) 631-2020

QUOTE #8814MW
November 9, 1983

integ
NOV 15 1983
G. Cooper.
File

Integ
Intercontinental Engineering Ltd.
1155 West Pender St.
Vancouver, B.C.
V6E 2P4

Attention: Mr. G. R. Cooper, Project Manager

Your Ref: File 0243-E1

Our Ref: Q-8814MW

Dear Sir:

We are pleased to present our proposal for the design and supply of one (1) only Flue Gas Cooler.

Industrial Combustion and Equipment Ltd. (hereinafter known as the Seller) proposes to supply to INTEG (hereinafter known as the Purchaser), the equipment as described in the following proposal.

SUPPLY

One shell and tube "U" tube heat exchanger which will be placed into the flue gas duct to cool .474 kg/sec. of flue gas from 1100°C to 150°C.

The unit will be rectangular in shape and should be bolted to the side wall of the duct. Further data is as follows:

Model:	IC 2805-3/4-2P-C.S.-SP
Surface Area:	275 sq. ft.
Water Flow:	50 U.S.G.P.M.
Water Connections:	2"Ø x 150# S.O.R.F.
Material of Construction:	All Wetted Parts C.S.
Baffles and Support Pieces:	RA330 or equivalent
Size: (Approx.)	2'-0" x 2'-0" x 5'-0" lg.

Note: Water must be flowing through heat exchanger before hot gas is allowed to enter unit.

.../2

152-1

ELLETT COPPER AND BRASS
PORT COQUITLAM

RECEIVED
NOV - 9 1983
FILE 0241-152-1

4
INTEG VCR

ELLETT PTCQ
NOV 9/83 1154

G R COOPER

RE YR FILE 0243-E1
OUR 83-522
1 ONLY FLUE GAS TO WATER HEAT EXCHANGER

WE OFFER A BUDGET PRICE OF 30,000.00

ON THIS EQUIPMENT
SOME OF THE PARTICULARS ARE:

-SHELL DIA 24 IN
-LENGTH (O/A) 13 FT
-SURFACE AREA 143 SQ FT
-U TUBE DESIGN
-F STYLE SHELL
-ALL CS CONSTRUCTION
-INTERIOR OF SHELL LINED

WE TRUST THIS INFORMATION WILL BE USEFUL TO YOU AND LOOK FORWARD TO THE OPPORTUNITY TO MAKE A FIRM QUOTATION ON THIS EQUIPMENT IN 1984

REGARDS

J A VANDEVENTER
ELLETT PTCQ
END GM

PRICE

Price of above described equipment F.O.B. Our shop, Dorval, Quebec, exclusive of all taxes would be:

PRICE: $7,900.00 Canadian Funds

Valid 30 days.

An interest of 2-1/2% per month is applicable on all accounts not paid according to the above mentioned terms.

DELIVERY

12 - 14 weeks after receipt of approved drawings.

TERMS

Net 30 days after delivery.

Our designs are in accordance with A.S.M.E. Section VIII Div. 1 and T.E.M.A. Standards.

Our welders are certified pressure welders, and our Quality Control Program (in accordance with C.S.A. Z-2999.3) has Provincial Government approval.

We would like to thank you for the opportunity of bidding on the supply of this equipment and trust it meets with your requirements.

Yours very truly,

INDUSTRIAL COMBUSTION AND EQUIPMENT LTD.

M. Walker.

Mike Walker

MW/ma

Enclosures

WARRANTIES

Industrial Combustion and Equipment Ltd. warrants the equipment manufactured by them and not by others to be free from defects in workmanship and material under normal use and service for a period of one year from date of delivery. Components manufactured by others, including expendable items, are warranted only in accordance with the warranty, if any, issued by such other manufacturer. Upon written notice from purchaser specifying the particular defect, or defects, Industrial Combustion will correct, without charge, any workmanship which is demonstrated to their satisfaction, to have been defective at time of installation or erection, and will repair, or replace, without charge F.O.B. Dorval, Que., parts which, upon inspection, are found defective under normal use within the warranty period above stated.

All work of removal and reinstallation or installation of parts, whether or not found defective, all shipping charges for defective or replacement parts shall be at the sole expense of the purchaser. The foregoing warranty shall not apply to i) work done or materials furnished by others in connection with work performed without supervision by Industrial Combustion's engineer, or, ii) equipment repaired or altered by others, unless such repairs or alterations were specifically agreed to by an officer of Industrial Combustion and Equipment Ltd. The foregoing warranty is exclusive, and in lieu, of all other express and implied warranties whatsoever. Industrial Combustion shall not be subject to any other obligations or liabilities whatsoever with respect to equipment manufactured or supplied by, or services rendered by them.

May 26, 1983

CHARGES FOR SERVICE

Listed below are Industrial Combustion and Equipment's service charges for Industrial; Boiler; Boiler Burner; and Controls services.

NORMAL HOURLY RATE:

This rate applies for 8 hours (or less) of work per day (Monday through Friday). Normal working hours are 8 a.m. to 5 p.m.

$ 45.00 per manhour net.
360.00 net per 8-hour day per man.

NORMAL OVERTIME:

1. First 4 hours (per man) worked in addition to 8 hours of normal time.
2. All work after 5 p.m. for 8 hours (per man) (Not to exceed 12 consecutive hours - 4 normal and 8 hours after 5 p.m.).

$ 67.50 per manhour net

DOUBLE OVERTIME:

1. Second 4 man hours worked in addition to 8 hours of normal time and first 4 hours of Normal Overtime.
2. All work after 5:00 p.m. on Saturday.
3. Sunday and Holidays normal working hours are 8:00 a.m. to 5:00 p.m. (8 normal overtime - 8 double overtime) - not to exceed 16 consecutive man hours.

$ 90.00 per manhour net.

TRIPLE OVERTIME:

1. All work after 16 hours of consecutive time.
2. All work after 5:00 p.m. on Sundays and Holidays - not to exceed 16 consecutive manhours (8 double time and 8 triple time).

$ 135.00 per manhour net

TRAVEL TIME:

Is considered working time but is charged at normal hourly rate regardless of when it occurs.

EXPENSES:

Actual expenses for lodging, meals, travel and incidental costs.

Auto mileage is charged at rate of 25¢ per kilometer.

NOTE:

Customer also is expected to pay living and travel expenses including:

- First class air fare.
- Car rental.
- Taxi tolls.
- Meals.
- Lodging, etc.

152-1

Neptune
Dynamics
Limited

December 15, 1983

Integ
1155 West Pender
Vancouver, B.C.
V6E 2P4

Integ
DEC 16 1983
GRC

Attn: G.R. Cooper, P. Eng.

Re: Energy Mines and Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Equipment Cost Estimate

Dear Sir:

We are pleased to provide our price for a heat exchanger made from Mueller Template which we believe is the most suitable for the proposed service.

The exchanger is a bank of 7 only 23" x 120" Mueller Templates each made of Type 304 Stainless Steel material, 16 ga. in thickness and which is ASME rated at 190 psi working pressure. The bank is contained in a rectangular shell with general dimensions as shown on the attached sketch SK-JRG-112283. Three of the seven plates are connected to the supply and return water headers with Swagelok fittings and are therefore removable from the heat transfer circuit. An option is available to remove these plates physically from the exchanger through a removable end plate.

The plates would be fabricated by Paul Mueller Company, Springfield, Missouri, and the headering and casing would be provided in Canada.

......Page 2

1616 West 3rd Avenue, Vancouver, B.C. V6J 1K2 Phone (604) 734-6982, (604) 687-0887 Telex 04-51592

Operating and Design Conditions

		Shell Side	Tube Side
Fluid circulated		Flue Gas	Water
Maximum flow rate	(kg/s)	0.304	1.83 kg/sec
Design flow rate	(kg/s)	0.474	1.83 kg/sec
Temperature in	(°C)	860	29
Temperature out	(°C)	150	66
Design Temperature	(°C)	1,100	-
Operating Pressure	(kPag)	-2	470
Density	(kg/Am^3)	0.326	996
Specific heat	(kJ/kg°C)	1.143	4.187
Entrained particulate	(kg/s)	0.03	-
Cleanliness factor	(%)		
Inlet connection size	(mm)	300	50
Outlet connection size	(mm)	200	50

Exchanger type	Plate and shell-true counter flow
Exchanger orientation	Vertical
Material requirements	Stainless steel Heat Transfer Surfaces

Our price for the complete unit as specified would be \$ Cdn. 11,910 F.O.B. Ottawa, Federal Taxes if applicable extra, Provincial Taxes extra.

This price is firm for 60 days from date of offer and delivery is approximately 6 weeks after receipt of approved drawings.

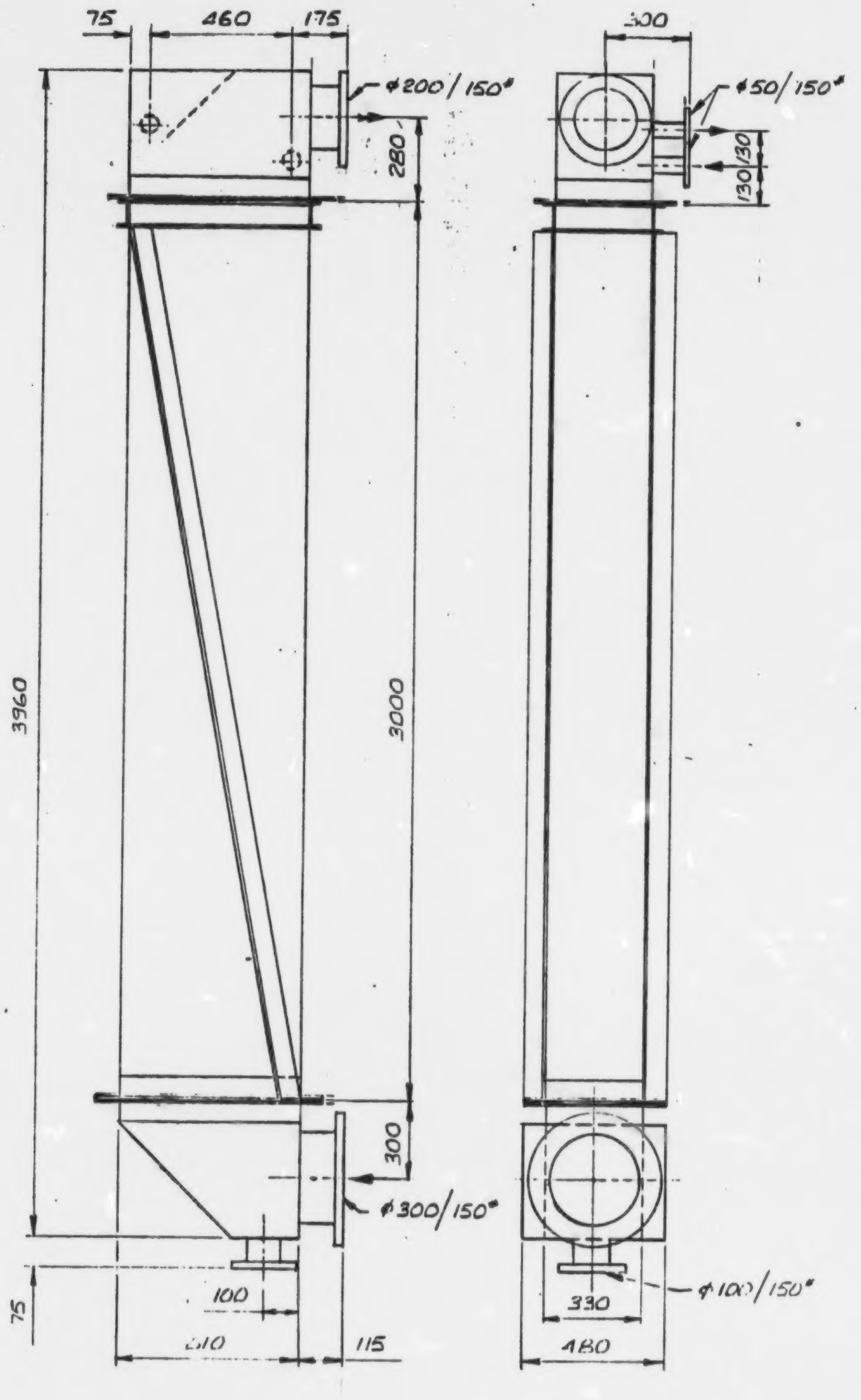
I hope this exchanger will satisfy your requirements.

Yours very truly

NEPTUNE DYNAMICS LIMITED

J.R. Green, P. Eng.
President

JRG/eld
Encl.


75
460
175
300
ϕ200/150#
ϕ50/150#
280
130
130
3960
3000
300
ϕ300/150#
75
100
610
115
330
480
ϕ100/150#

DRAWING No
SK-JRG-112283
SCALE 3/4"=1"

NEPTUNE DYNAMICS LTD.
VANCOUVER, B.C.

CLIENT INTEG

TITLE FLUE GAS TO WATER HEAT EXCHANGER

152-1 FLUE GAS COOLER

RECEIVED
FEB 01 1984
DATE
FILE

+
INTEG VCR

ISKO HX MTL
JAN 31/84

ATT: MR. G. R. COOPER, P. ENG., PROJECT MGR.

REF: YOUR FILE NO. 0243-E1

YOUR ABOVE INQUIRY WAS MAILED TO WRONG ADDRESS, RECEIVED YESTERDAY, HOPE IT IS NOT TOO LATE - PL. NOTE OUR ADDRESS:

ISKO HEAT EXCHANGERS LTD.
2700 DE MINIAC
ST. LAURENT, QUEBEC

OUR PROPOSAL IS AS FOLLOWS:

24'' DIA X 10'-0'' TUBE LENGTH, 6-TUBE PASSES, TEMA-BEU TYPE HEAT EXCHANGER SUITABLE TO COOL FLUE GAS 1.045 KG/S FROM 860 TO 150 DEG C USING 40 USGPM OF WATER 29 TO 66 DEG C.

1,312,539 BTU/HR, 220 SQ FT, P.D. 1.5 PSI WATER, GAS NEGLIGIBLE. APP. WT. 4000 LBS.

EXPANSION JOINT SHELL SIDE ALLOWED.

MATERIAL IN CONTACT WITH GAS ALLOY 7RE10 OR EQUIVALENT, REST MATERIAL CARBON STEEL.

OUR PRICE: 64,500.00

ALL TAXES EXTRA, FOB OUR PLANT, DELY APP. 16 WEEKS.

REGARDS
ISHY KHAN
ISKO HEAT EXCHANGERS LTD.
514-337-5192
05-824685

P.S. IF FURTHER INFO IS REQUIRED PL. DO NOT HESITATE TO CALL

ISKO HX MTL
+
INTEG VCR

153-1

WATER COOLING SYSTEM

TCC-T

BIDDERS LIST

WATER COOLING SYSTEM (153-1)

G.R. Hudson Sales Ltd.
P.O. Box 94305
Richmond, B.C.
V6Y 2A6

Attention: Mr. G.R. Hudson

Bruce St. C. Patrick Ltd.
2490 Blenheim Street
Vancouver, B.C.
V6K 4K3

Attention: Mr. B. Patrick

(BROCHURES INCL.) 153-1

G.R. Hudson Sales Ltd.

Telephone (604)~~XXXXXX~~ 594-1342
P.O. Box 94305
Richmond, B.C. V6Y 2A6

December 7, 1983.

integ
DEC-8 19[illegible]
GRC

Integ-Intercontinental Eng. Ltd.,
1155 West Pender Street,
Vancouver, B.C.
V6E 2P6

Re: Ministry of Energy, Mines & Resources,
Ottawa, Ontario,
Your file # 0243-153.

Attention: Mr. G.R. Cooper.

Dear Sir:

We are pleased to submit our Tower/Heat Exchanger quotation for this project.

Heat Exchanger:

One (1) only Baltimore Aircoil Model HK-8-14-3-1A High K heat exchanger with capacity as follows -

The High-K heat exchanger shall cool 135 USGPM of water from 151°F. to 84°F. with 229 USGPM of water entering at 79.8°F. Shell side pressure drop will be 4.4 PSIG and the tube side pressure drop will be 8.0 PSIG.

Shipping weight: 2,225 lbs.
Operating weight: 3,410 lbs.

Unit plan dimensions will be 195" x 60" high x 17" wide.

For complete details on the HK-8-14-3-1A Heat Exchanger kindly refer to Bulletin S903/1-0.

Cooling Tower:

One (1) only Baltimore Aircoil Model #VXT-185 centrifugal fan forced draft Cooling Tower.

To cool 229 USGPM of water from 118.1°F. to 79.8°F. with a entering air wet bulb of 73°F.

Included:

One (1) 30 HP. 575v/3/60cy fan motor with 1.15 service factor for 1/4" E.S.P.
Oversized side mounted remote sump connection
Modulating freeze-proof capacity control dampers complete with electric damper controls

Approximate shipping weight: 4,970 lbs.
Approximate operating weight: 4,280 lbs.

Pressure drop at inlet header - 1.0 PSIG.

Approximate make-up water requirements - 20 USGPM at design.

Total Price for the HK8-14-3-1A Heat Exchanger and the Model #VXT-185 Cooling Tower - $24,600.00

All Taxes Extra.
F.O.B. Georgetown, Ontario with freight prepaid & allowed to the Ottawa jobsite.
See Attachment II for "Acceptances and Prices."

Not Included:

Structural steel supports
Process pump and pump motor
Starters or disconnect switches & wiring
Cooling Tower remote sump tank
Float, make-up valve and strainer
Rigging, hoisting or final assembly

Extra Price for the BALTIBOND Four Part Corrosion Protection System as detailed in the attached Bulletin S650/1-0 -

Total Extra Price $1,300.00

We believe this is the required information and kindly refer to the following enclosures for complete details -

1) Bulletin S280/1-0 VX Cooling Towers.
2) Bulletin S903/1-0 High K Heat Exchanger.
3) Bulletin S650/1-0 BALTIBOND Corrosion Protection.
4) Drawing VR 4505A Shop Drawings.
5) Drawing BAC-2045A Damper Wiring.

Sincerely yours,

Gary R. Hudson

G.R. Hudson Sales Limited
Sales Representative for
BAC-Pritchard of Canada.

G.R. Hudson Sales Ltd.

Telephone (604) 271-8555
P.O. Box 94305
Richmond, B.C. V6Y 2A6

" Acceptances and Prices."

1) The prices in this quotation are firm, subject to acceptance within 30 days.

2) Prices will remain firm, provided the order is released for fabrication within six months after receipt of the order at the factory and shipped within standard published factory lead times.

3) For each additional month's delay in release or part thereof beyond the above paragraph, an additional 1 per cent month price increase will apply for a period not to exceed six months beyond the six-month protection policy. After this date, price in effect at time of shipment will apply.

4) If an order is released and shipment of the equipment is not accepted when it is produced, billing will be subject to the same price escalation as would have been normal through a correct release.

5) Orders should be made out to: Baltimore Aircoil of Canada, c/o G. R. Hudson Sales Limited.

Representing
Baltimore Aircoil of Canada
Division of Baltimore Aircoil Interamerican Corp
Affiliate of Merck & Co. Inc.
Cooling Towers • Evaporative Condensers • Closed Circuit Coolers

SCHEDULE I - SCHEDULE OF PRICES

WATER COOLING SYSTEM

1.	Heat exchanger as described in the specification, FOB point of sale	$ 8,400.00
2.	Cooling tower as described in the specification, FOB point of sale	$ 14,500.00
3.	Canadian Customs Duty _____ % of $ __________	$ Nil
4.	Transportation to site	$ 1,700.00
	TOTAL	$ 24,600.00

SCHEDULE II - TECHNICAL DATA

WATER COOLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name	Baltimore Aircoil of Canada		
Vendor's Name	Baltimore Aircoil of Canada		
Model and Type			
- Exchanger	Shell and tube Model HK8-14-3-1A		
- Cooling tower	Centrifugal Model VXT-185		
Heat Exchanger	**Shell Side**	**Tube Side**	
Water flow			
- normal	--	--	kg/s
- design	7.438	12.866	kg/s
Temperature			
- in	66	26.5	°C
- out	29	47.83	°C
Pressure			
- normal			kPag
- design	1034	1034	kPag
- test	1551	1551	kPag
Pressure drop			
- normal	--	--	kPag
- design	30.34	55.16	kPag
Water connection size	152	152	mm
Duty		4,637,358	kJ/h
Tube withdrawal space		4,572	mm

Shell outside dia.	22	mm
Tube diameter and thickness	22 OD 20.5 ID	mm
Material		
- tubes	Cooper	
- shell	Carbon Steel	
Weight		
- dry	900.46	kg
- flooded	1,380	kg
Cooling Tower		
Duty	4,626,544.2	kJ/h
Makeup water requirement		
- normal	---	kg/s
- design	1	kg/s
Water pressure drop		
- normal	---	kPag
- design	2.4	kPag
Fan capacity	16.9	Am^3/s
Fan RPM		
Fan power	22.38	kW
Motor		
- manufacturer	---	
- power output	---	kW
- speed	1,800	rpm
- enclosure type	TEFC	
- temperature rise	40	°C
- frame size	---	

Damper motor manufacturer, type and size model no. Honeywell

Damper motor power requirements 40 **VA** 24 **V** 1 **phase**

Water connection sizes

- **inlet** 152 **mm**
- **drain** 152 **mm**

Air connection dimensions

- **intake** 3657 x 1625 **mm**
- **discharge** 3657 x 1473 **mm**

Unit dimensions

- **height** 5.18 **m**
- **length** 3.65 **m**
- **width** 1.42 **m**

Weight

- **empty** 1,732 **kg**
- **flooded** 2,011 **kg**

Type of corrosion protection Mill galvanized steel coated with zinc chromatized aluminum paint.

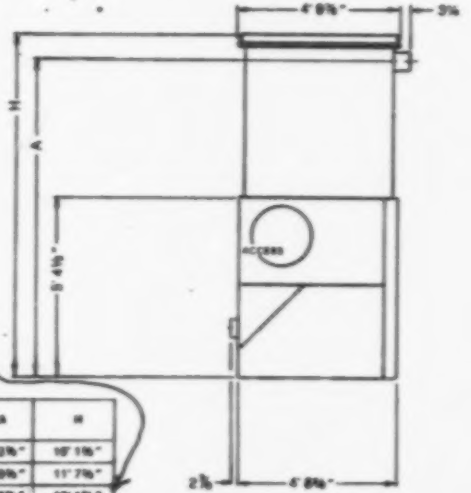
2.0 LIST OF ALTERNATIVES OR DEVIATIONS

For additional corrosion protection we propose that the Cooling Tower be supplied with our four part BALTIBOND Corrosion Protection System at a Extra Cost of $1,300.00

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3 1/2 **months**

153-1
GP HUDSON

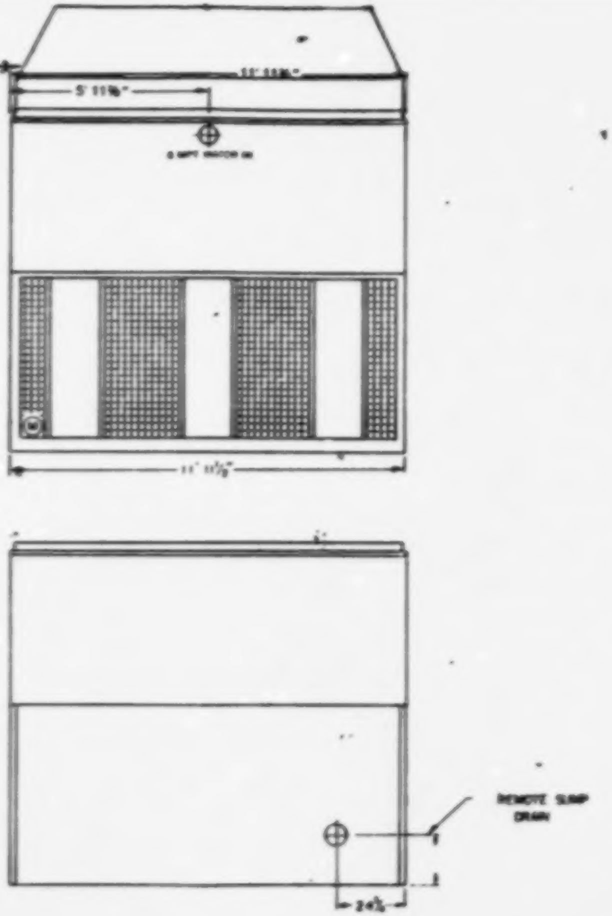


NOTE
DISCHARGE HOOD WILL ADD 4 FT TO UNIT HEIGHT

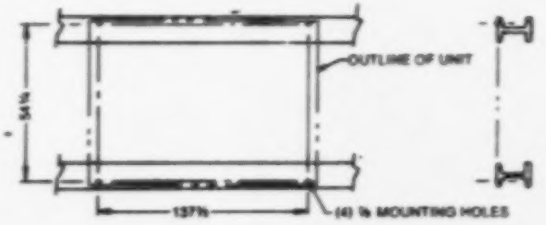
Ⓜ Fan motor location.

MODEL NO.	APPROX. SHIPPING WEIGHT	APPROX. OPERATING WEIGHT	A	H
VXT 160	3610	4200	9' 3⅝"	10' 1⅛"
VXT 165	3930	4520	10' 9⅝"	11' 7⅛"
VXT 185	4280	4870	12' 3⅝"	13' 1⅛"

NOTE
FOUR FOOT HIGH DISCHARGE HOOD



SUGGESTED SUPPORT DETAILS



NOTES:

1. The recommended support arrangement for VX units consists of two parallel I-beams extending the full length of the unit. Supports and anchor bolts are to be designed and furnished by others.
2. All supporting beams are to be flush and level at top and must be oriented relative to gage line as shown.
3. Recommended design loads for each beam should be 65% of the total unit operating weight applied as a uniform load to each beam. Beams should be designed in accordance with standard structural practice. The maximum allowable deflection of beams under the unit shall be 3/8 of an inch.
4. All mounting holes are 7/8 inch dia. at the locations shown.
5. If vibration isolators are used, a rail or channel must be provided between the unit and the isolators to provide continuous unit support. Additionally, the support beams must be designed to accommodate the overall length and mounting hole location of the isolators which may differ from those of the unit. Refer to vibration isolator drawings for these data.

NOTES: 1. All dimensions are in feet and inches. Weights are in pounds.
2. Unless otherwise indicated, all connections 5 inches and smaller are MPT and connections 6 inches and larger are bevelled for welding.

B A C ORDER NO	**BALTIMORE AIRCOIL** [illegible]	COOLING TOWER
DATE		DWG NO VR 4505 A

153-2

COOLING WATER PUMPS

153-2

BIDDER'S LIST

COOLING WATER PUMPS (153-2)

B & D Engineering Sales Ltd.
2402 Shell Road
Richmond, B.C.
V6X 2P1

Bennett and Emmott Ltd.
2031 No. 5 Road
Richmond, B.C.
V7A 4E9

W.F. Keenan Ltd.
306 - 2150 W. Broadway
Vancouver, B.C.
V6K 4L9

Attention: Mr. D. Wilkinson

Fleck Bros. Ltd.
110 Alexander Street
Vancouver, B.C.
V6A 1B6

BROCHURES INCL. 153-2

db

B. & D. Engineering Sales

2402 SHELL RD., RICHMOND, B.C.
CANADA V6X 2P1 TELEPHONE: (604) 273-9481
TELEX: 043-55584

OUR REFERENCE NUMBER PR 1922

December 15, 1983

integ
DEC 16 1983
G.C.
FILE

INTEG
1155 West Pender Street
Vancouver, B.C. V6E 2P4

ATTENTION: G.R. Cooper, P. Eng.

SUBJECT: Goulds Pumps - file 0243-E1
CANMET Laboratories - Ottawa

Sir,

Thank you for this opportunity of quoting behalf of Goulds Pumps Canada Inc. the following.

1. Circulating Pump

1 - GOULDS 3196ST pump, 1x1½-8 in all iron construction, the pump will be supplied with baseplate, Woods coupling, guard and a 15HP, 3600 RPM TEFC motor. The entire assembly will be mounted and preliminarily aligned on the bedplate prior to shipping.

PRICE: .... $ 2,020.00

2. Cooling Water Pump

1 - GOULDS 3196MT pump, 3x4-8 as described above except a 7½HP, 1800 RPM motor is included.

PRICE .... $ 2,799.00

Prices are FOB Cambridge, Ontario, in Canadian funds with all taxes extra. Freight to Ottawa on the two units is estimated at $155.00. Payment terms are net 30 days on shipping.

We enclose for your reference
- schedule I - prices
- schedule II - technical data
- pump estimate sheets (2)
- pump performance curves (2)
- descriptive literature

We hope this proposal is favoured with your purchase order. If we can be of any further service or provide any additional information, please call.

Yours very truly,

B & D ENGINEERING SALES

A.J. MacLean, C.E.T.

AJM:ap
Encl.

c.c. Gordon Banks, Goulds Pumps Canada, Mississauga, Ontario

GOULDS PUMPS, INC.
SENECA FALLS NEW YORK 13148

CENTRIFUGAL PUMP
QUOTATION

REPLY TO:

GOULDS PUMPS CANADA
6205 AIRPORT ROAD
BUILDING A, SUITE 309
MISSISSAUGA, ONTARIO, L4V1E1
CANADA

All quotations subject to terms and conditions on the reverse side except as noted on Page ________ attached.

SHIPMENT: Our best estimate at this time is ________ weeks after complete engineering and manufacturing information and full approval to proceed with work.

To: INTEG

Date: Dec 15/83 Page: 1
Proposal No.:
Revision No.:
Copies:

Attention: G.R. Cooper
Inquiry Date:
Inquiry No.:

In answer to your inquiry, we propose to furnish GOULDS PUMPS as described below:

ITEM NO.
EQUIP. NO. COOLING TOWER
SERVICE

Quantity	Model	Size	Rotation
1	3196MT	3x4-8	cw
Casing	**Impeller**	**Shaft**	**Sleeve**
DI	CI	4140	316
Wear Plate	**Lubrication**	**Base Plate**	**Coupling**
-	OIL	CI	Woods
Mechanical Seal – Packing			**Imp. Type**
			Open

OPERATING CONDITIONS AND PERFORMANCE

Liquid		Temp. °F	Sp. Gr. @ P.T.
Water		80	1.0
G.P.M.	**T.D.H.**	**V.P.**	**Visc.**
320	59	-	-
Eff.	**Rated B.H.P.**	**Max. B.H.P.**	**Suct. Press**
74	6.4	8	
Disch. Press	**Perf. Curve**	**NPSH$_R$**	**NPSH$_A$**
-	1589-1	5'	33'

Impeller Diameter Rated	Impeller Diameter Min.	Impeller Diameter Max.	Bulletin
7-3/4	6	8-3/8	725.1

DRIVER–

H.P.	R.P.M.	Enclosure	Frame	S.F./Insulation
7½	1800	TEFC	215T	1.0/B
Phase	**Hertz**	**Voltage**	**Furnished By**	
3	60	575	B&D	

WITH THE FOLLOWING ADDITIONS, MODIFICATIONS AND/OR REQUIREMENTS

ITEM	*PRICE	WEIGHT
Pump		
Driver		
Total Unit Price & Weight		

THIS QUOTATION VALID FOR 30 DAYS FROM DATE OF PROPOSAL SHOWN ABOVE.
* PRICES SHOWN ARE F.O.B. SHIPPING POINT
TERMS: NET 30 DAYS

[illegible]

GOULDS PUMPS INC

GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK 13148

CENTRIFUGAL PUMP
QUOTATION

REPLY TO:

GOULDS PUMPS CANADA
6205 AIRPORT ROAD
BUILDING A, SUITE 309
MISSISSAUGA, ONTARIO, L4V1E1
CANADA

All quotations subject to terms and conditions on the reverse side except as noted on Page ________ attached.

SHIPMENT: Our best estimate at this time is ________ weeks after complete engineering and manufacturing information and full approval to proceed with work.

To: INTEG

Date: Dec. 15/83 Page: 1
Proposal No.:
Revision No.:
Copies:

Attention: G.R. Cooper
Inquiry Date:
Inquiry No.:

In answer to your inquiry, we propose to furnish GOULDS PUMPS as described below:

ITEM NO. EQUIP. NO. SERVICE	Circulating Water		
Quantity	Model	Size	Rotation
1	3196ST	1x1½-8	cw
Casing	Impeller	Shaft	Sleeve
DI	CI	4140	316
Wear Plate	Lubrication	Base Plate	Coupling
-	OIL	CI	Woods
Mechanical Seal – [✓ Packing]			Imp. Type
			Open

OPERATING CONDITIONS AND PERFORMANCE

Liquid		Temp. °F	Sp. Gr. @ P.T.
Water		85	1.0
G.P.M.	T.D.H.	V.P.	Visc.
120	205	-	-
Eff.	Rated B.H.P.	Max. B.H.P.	Suct. Press
59	10	14	
Disch. Press	Perf. Curve	NPSH$_R$	NPSH$_A$
--	2100-2	8'	33'

Impeller Diameter			
Rated	Min.	Max.	Bulletin
7	5	8	725.1

DRIVER–

H.P.	R.P.M.	Enclosure	Frame	S.F./Insulation
15	3600	TEFC	254T	1.0/B
Phase	Hertz	Voltage	Furnished By	
3	60	575	B&D	

WITH THE FOLLOWING ADDITIONS, MODIFICATIONS AND/OR REQUIREMENTS

ITEM	*PRICE	WEIGHT
Pump		
Driver		
Total Unit Price & Weight		

THIS QUOTATION VALID FOR 30 DAYS FROM DATE OF PROPOSAL SHOWN ABOVE.
* PRICES SHOWN ARE F.O.B. SHIPPING POINT
TERMS: NET 30 DAYS

GOULDS PUMPS, INC.

STANDARD TERMS AND CONDITIONS

GOULDS PUMPS, Inc., Seneca Falls, N.Y., U.S.A.

All Sales and Transactions with Goulds Pumps, Inc., are subject to its Standard Terms and Conditions.

1. Warranty: The Company warrants that its pumps, when properly installed and cared for as stated in the appropriate instruction manual issued by the Company, will operate in accordance with its proposal.

Goulds Pumps are warranted to be made of first-class material, and in a skillful and workmanlike manner. They are additionally warranted against any defective material or workmanship and any part proven defective within one year from the date of shipment, after inspection by and to the satisfaction of the Company, will be replaced free of charge F.O.B. Shipping Point, or return of such defective part to the Company, transportation charges prepaid. No parts, however, shall be returned without the express authority of the Company so to do.

There are no warranties, express or implied, except such warranties as are definitely set forth herein. The Company shall not be liable for damage or wear to pump caused by abnormal conditions, vibration, failure to properly prime or to operate pump without flow or caused by corrosives, abrasives or foreign objects. No obligations other than those herein set forth shall be binding upon the Company. No warranties apply to other than the original user.

The Company shall in no event be held liable for damages or delay caused by defective material and no allowance will be made for repairs or alterations unless made by its written consent or approval. In the event the pumps are altered or repaired by others without prior written approval by the Company all warranties are void. Equipment and accessories not manufactured by the Company are warranted only to the extent of and by the original manufacturer's warranty.

Under no circumstances shall the Company be held liable for any consequential or other damages, losses or expense arising from installation, use, or any other causes, regardless of advice or recommendations that may have been rendered concerning such installation or use of its products; nor shall the Company be liable for penalties of any description.

2. Shipment: Promised shipping dates are approximate, and are from point of manufacture. Such dates are estimated from (a) the date of receipt of order with complete manufacturing information at Company's factory, and (b) the date of entry of such order by the Company. Shipping dates are subject to revision at the time of the entry of order and the shipping schedule shall be considered approximate and subject to any action Company must take in connection with priorities or other orders or regulations issued by the United States Government or any department thereof.

The Company will not be liable for loss, damage, detention, or delay in manufacture or delivery or necessity to substitute materials, resulting from causes beyond its reasonable control, including but not limited to casting failures, war, fire, strikes, lockouts, or other labor difficulties, civil or military authority, insurrection or riot, embargoes, car or ship shortages, acts of governments, wrecks or delays in transportation, including any delays caused by inability to obtain necessary labor, materials or manufacturing facilities due to such causes, or from action taken by the Company in connection with priorities or preference orders or other production permits issued by the United States Government or any department thereof, or from delay in obtaining or failure to obtain manufacturing, financing, export or other licenses required by the United States Government or any department thereof, or in any event for consequential damages.

Acceptance of material by common carrier constitutes a waiver of any claim against the Company for delay or damage in transit, or for lost goods.

When quotation includes equipment not of Company's manufacture, Company's promise of shipment is based on manufacturer's promise to Company and shipment is contingent on the fulfillment of their promise.

3. Prices: All prices are subject to change without notice and are subject to any increase which may be in effect on the date of shipment of the goods, such increase, if any, to be within any applicable government regulations. Prices are F.O.B. Shipping Point, unless otherwise specified. When price includes transportation and other charges pertaining to the shipment of the goods, any increase in transportation rates and other charges will be for the account of the purchaser. There will be an extra charge for any test other than that which may be normally run by the Company, or for any test performed to suit the convenience of the purchaser.

4. Terms of Payment: Terms and conditions of payment will be shown on invoices rendered by the Company at time of shipment or as may be otherwise stated in writing by an officer of the Company or his designee.

5. Orders: All illustrations and specifications are descriptive and are not intended as warranties. The acceptance of all orders taken by the Company's sales representatives or branches is subject to approval by an officer of the Company or his designee.

6. Cancellation of Orders: Orders once placed with and accepted by Company can be cancelled only with Company's consent and upon terms that will indemnify Company against loss.

I Company may forthwith cancel the order or contract without recourse

(a) if conditions are such that shipment from Company's factory may be delayed beyond the date estimated at the time of entry of order or contract;

(b) if the Purchaser is in default with the Company on this or any other order or contract.

(c) if Purchaser is or becomes insolvent, or if at any time Company is not fully satisfied with the credit of Purchaser, it may at any time after the order has been entered, or during the manufacturing period, or at the time the goods are ready for shipment, require payment in advance of shipping regardless of original terms, or if after shipment has been made and before actual delivery and acceptance at destination, (regardless of F.O.B. point) it may recall the shipment and cancel this and any and all other orders and contracts which may be outstanding, and shall be entitled to receive reimbursement for its reasonable and proper cancellation charges.

(d) if the order or contract is for the direct account of one of its sales representatives, distributors or dealers, and Company terminates or alters such relationship.

II The Company shall have at all times a right of set off as to any and all accounts between it and Purchaser.

7. Claims: No claims for allowances will be entertained unless presented immediately on receipt of goods, nor will Company be held responsible for breakage or shortage after goods are delivered to and accepted by the common carrier.

8. Equipment Returned: Goods can be returned for credit only after receiving Company's authorization and shipping instructions. Consignor's name and address must be plainly written on the shipping tag.

9. Taxes: All Federal, State, Local and Municipal taxes now in effect or hereafter enacted that are applicable to this transaction shall be paid for the account of the Purchaser, and if paid or required to be paid by the Company, the amount thereof shall be added to and become a part of the price payable by the Purchaser hereunder.

10. Minimum Charge: Every order received by the Company is subject to the minimum charge in effect on the date of order acceptance.

11. General: All sales and transactions are subject to Company's Standard Terms and Conditions, and they shall prevail in the event of any conflict or variance with those of the Purchaser's, unless otherwise agreed to in writing.

All previous agreements, either written or oral which are subject matter hereof, are hereby cancelled.

Stenographic or clerical errors are subject to correction.

If this transaction involves EXPORT, the following additional terms and conditions shall apply.

12. Packing: Equipment will be packed, boxed or crated in accordance with the Company's standard commercial practice, for underdeck export shipment, unless otherwise agreed.

13. Payment: Unless otherwise specified in writing, payment shall be made by irrevocable letter of credit in form acceptable to Company, confirmed by a major USA bank, acceptable to the Company and providing for payment in full in United States dollars against presentation of United States inland shipping documents and invoices, such letter of credit to be established prior to Company's acceptance of the order. The letter of credit shall provide also that in the event Company is, for any reason beyond its control, prevented from making shipment from Company's factory or delivery at the port of embarkation, a certificate of manufacture of the whole or any part of the goods shall constitute delivery of such whole or any part of the goods and payment in full of any and all drafts drawn against the letter of credit for the goods so "delivered" shall be made upon presentation of such certificate of manufacture in lieu of United States inland shipping documents. In the event that Company is prevented by law, or otherwise, from making shipment from Company's factory or delivery at port of embarkation of the goods or any part thereof, on completion of manufacture, Company reserves the right to place the goods in storage for the purchaser's account and risk. Any charges incurred in this connection will be for the account of the purchaser at cost and will by payable upon demand.

14. Company as Agent: If Company makes or arranges for ocean shipment, Company shall act as agent for the purchaser and reserves the right to procure full insurance coverage, including war risk insurance, at the expense of the purchaser. All expenses incurred in this connection will be payable upon demand to the Company.

If Company applies for or secures manufacturing, financing, exporting or other licenses required by the United States Government, or any department thereof, Company shall make such applications or secure such licenses solely as agent for the purchaser, and assumes no responsibility therefor.

STC 0179

PRINTED IN U.S.A.

SCHEDULE I - SCHEDULE OF PRICES

COOLING WATER PUMPS

1.	Pumps as described in the specification, FOB point of sale	
	a) Circulating water pump	$ 2020.00
	b) Cooling water pump	$ 2799.00
2.	Canadian Customs Duty _____ % of $ __________	$ NONE
3.	Transportation to site	$ 155.00 (EST @ 15^{00}/CWT)
	TOTAL	$ 4974.00

SCHEDULE II - TECHNICAL DATA

COOLING WATER PUMPS

1.0 SPECIFICATIONS

Manufacturer's name GOULDS PUMPS CANADA INC.

Vendors name B + D ENGINEERING SALES.

	Circulating	Cooling Tower
Volume m^3/s	0.0075	0.020
Discharge pressure kPa (g)	612	176
Inlet size mm	40	200
Discharge size mm	25	150
Drive type	COUPLING	COUPLING
Pump RPM	3500	1750
Motor	3196 ST 1x1½-8	3196 MT 3x4-8
- manufacturer	CGE	CGE
- power output	11 kW	5.6 kW
- speed	3500 rpm	1750 rpm
- enclosure type	TEFC	TEFC
- temperature rise	40 °C	40 °C
- frame size	254T	213T
Net weight	220 kg	250 kg
Overall dimensions	mm	mm
PUMP NOISE	72 DbA	67.5 DbA

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order TWO **months**

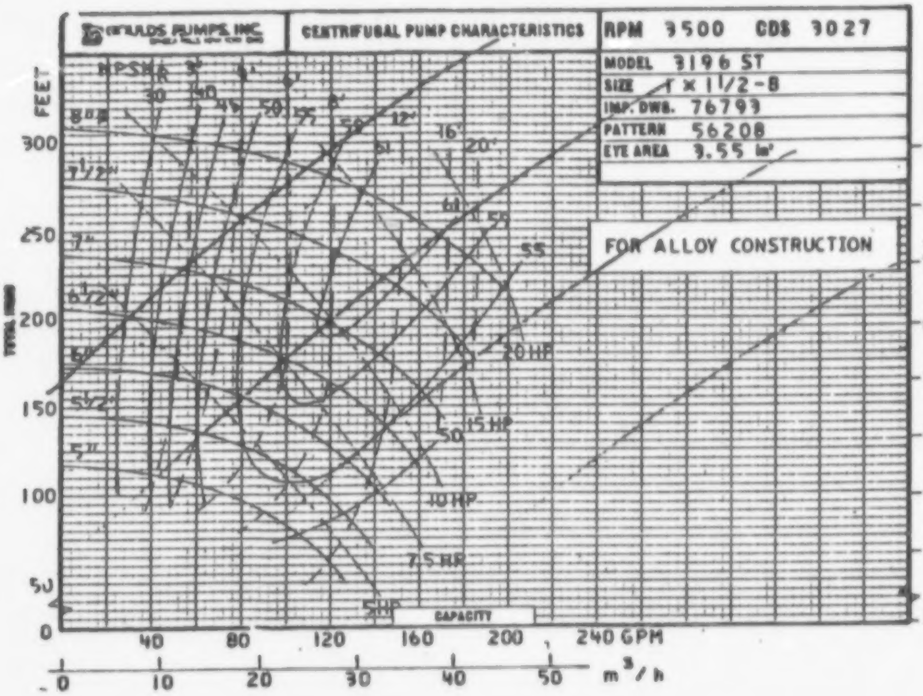
Goulds Model 3196 ST

60 Hz Performance Curves

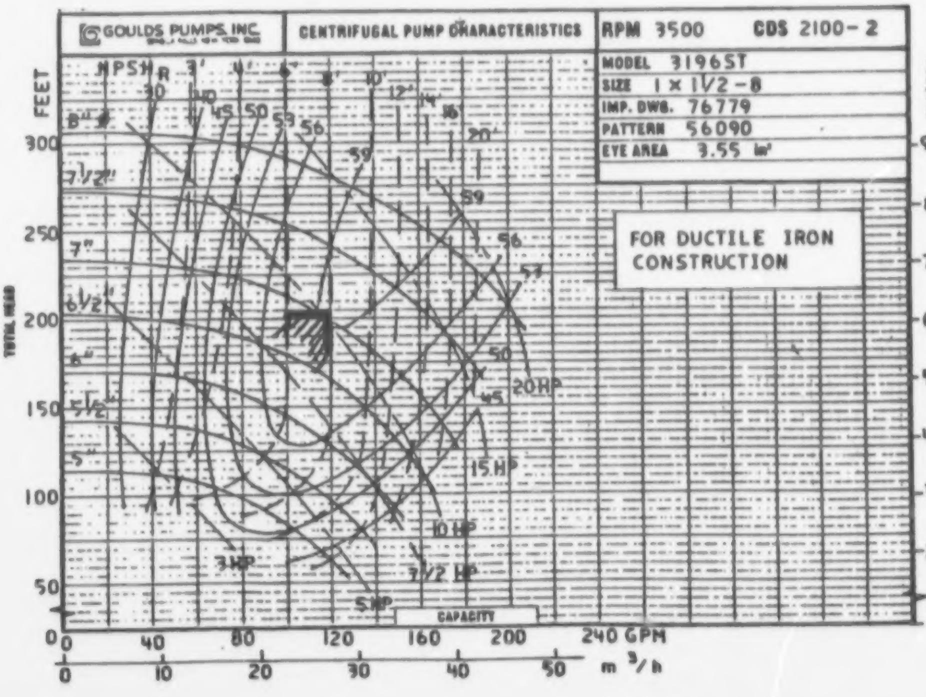
725.1C2

June 8, 1982
(New)

Customer INTEG – CANMET – OTTAWA Inquiry No. ________ Date ______
Service WATER Item No. CIEC, P.O. No. ________ Date ______
F.O. No. ______ ; 120 GPM; 205 TDH; 3500 RPM; 59 % Eff.; CDS No. 2100-2



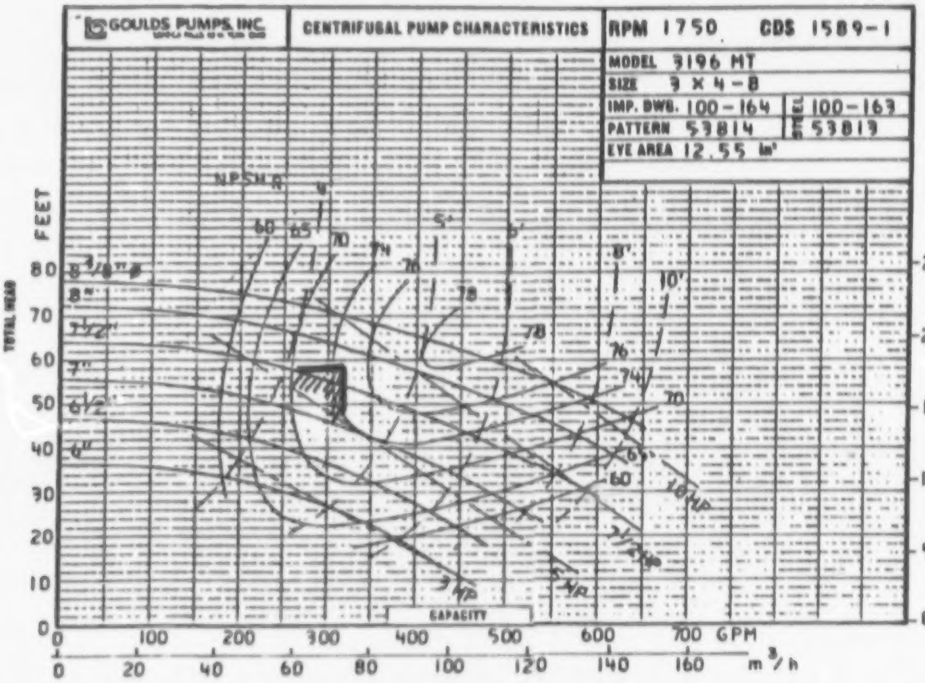
3500 R.P.M.



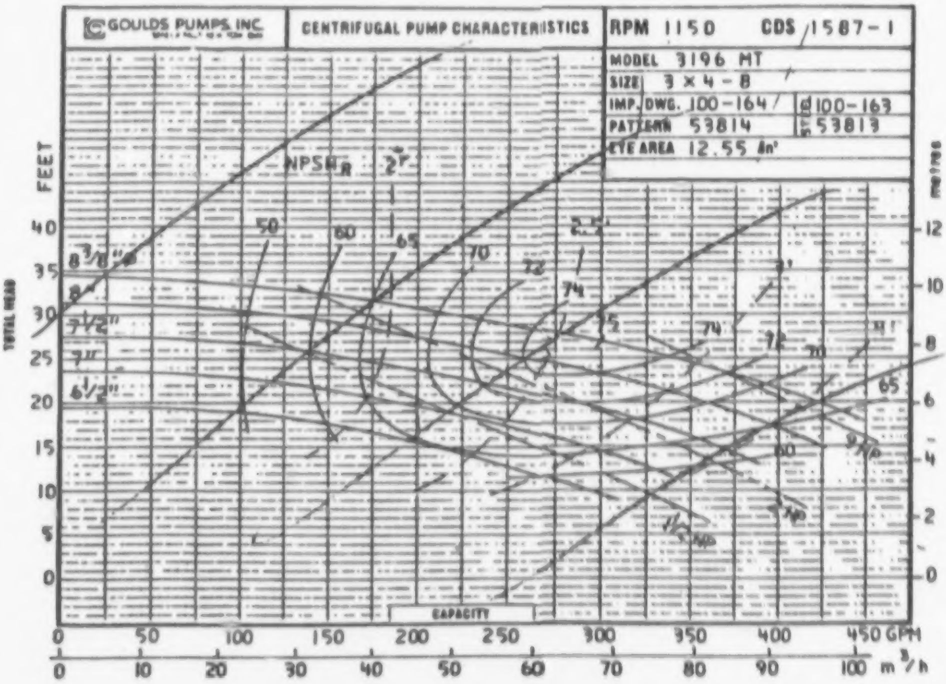
3500 R.P.M.

Customer *INTEG - CANMET - OTTAWA* Inquiry No ____________ Date ________
Service *WATER* Item No. *COOLING* P.O. No. ____________ Date ________
F.O. No. ________ ; *320* GPM; *59* TDH; *1750* RPM; *74* % Eff.; CDS No. *1589-1*

1750 R.P.M.



1150 R.P.M.



GOULDS PUMPS, INC.
SENECA FALLS NEW YORK 13148

PRINTED IN U.S.A.

BROCHURES INCL.

153-2

Canadian Blower / Canada Pumps
LIMITED
HEAD OFFICE 90 WOODSIDE AVENUE
KITCHENER, ONTARIO N2G 4K1

CANADIAN BUFFALO

WILLIAM F. KEENAN, P. ENG.
BRANCH MANAGER

ADDRESS REPLY TO
ROOM 306, 2150 WEST BROADWAY
VANCOUVER, B.C. V6K 4L9
PHONE (AREA CODE 604) 731-5808
TELEX NO. 04-53405
TWX 610-929-3025

PLEASE QUOTE REFERENCE NO.
P-1364

Dec. 14, 1983

integ
DEC 15 1983
CIRC. | DATE
G.R.C.
FILE

Intercontinental Engineering Ltd.,
1155 West Pender St.,
Vancouver, B.C.
V6E 2P4

Attn: Mr. G. R. Cooper, P. Eng.
Project Manager

Dear Sir:

Re: Energy Mines & Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
File No. 0243-E1

With reference to your inquiry dated Dec. 1, 1983, we are pleased to quote on the following equipment.

Our quotation includes the completion of the Summary Sheets that were attached to your inquiry.

Our detailed selection is as follows.

Circulating Water Pump

1 only - 3 x 1½ x 9 CRO pump, selected for a rating of 450 litres/min. (120 USGPM) against a total head of 63 metres (205 ft. T.H.) when operating at 29°C (85°F). The pump will operate at 3500 RPM requiring 9.1 KW at the pump shaft (12.2 BHP). The required NPSH is 2.1 (6.8 ft.).

The pump will be constructed with cast iron casing, bronze impeller, and Type 303 stainless steel shaft. The pump will have a packed stuffing box, and we recommend the use of a Type 410 stainless steel hardened shaft sleeve which we have included in our price. The pump will be supplied complete with a structural steel base to support the pump and its motor. The pump will be supplied with a Woods spacer type flexible coupling and coupling guard. Our price also includes the supply of a 15 HP 3/60/575/3600 RPM TEFC motor in frame 254T.

Cont..

Quotations subject to change without notice, typographical errors not binding, all agreements contingent upon strikes, accidents and other delays unavoidable or beyond our control. All contracts and orders taken subject to approval of an executive officer of the company. Terms are 30 days net. No cash discount.

Cooling Tower Pump

1 only - 4 x 3 x 11 CRO pump, rated at 1210 litres/min. (320 USGPM) against a total head of 18 metres (59 ft.) when handling water at 27°C (80°F), 1750 RPM, 4.8 KW at the pump shaft (6.4 BH), requiring 1.16 metres NPSH at the rating (3.8 ft.).

The pump construction will be as shown for the Circulating Water Pump. In this instance the electric motor supplied will be a 7-1/2 HP 1800 RPM in frame 213T.

We enclose catalogue literature, dimension prints, and performance curves for the pumps we have selected.

Note that the prices shown on the Schedule of Prices are net, FOB our factory in Kitchener, Ontario. Freight as been shown as a separate item. Taxes are not included in the price.

I mentioned earlier that our prices included hardened 410 stainless steel shaft sleeves. Our basic pump construction utilizes a stainless steel shaft made in Type 303 S.S. This shaft sleeve is an optional item. I included the hardened 410 stainless steel shaft sleeve in the basic quotation, although no shaft sleeve was specified. There are other options in shaft sleeves and, of course, there is the option of not putting one on at all. We can also provide the pumps with mechanical seals, if that is your desire.

Should you require additional information, please contact either the writer or Mr. D. S. Wilkinson.

Yours very truly,

CANADIAN BLOWER/CANADA PUMPS LTD.

W. F. Keenan, P. Eng.
em
enc.

CANADIAN BLOWER/CANADA PUMPS LIMITED
KITCHENER, ONTARIO

TERMS OF SALE NO. 10
TERMS AND CONDITIONS OF SALE

1. No order or contract shall be binding upon us until accepted and acknowledged by the Company. Sales representatives are not authorized to bind us. Typographical errors are not binding.

2. We shall not be held responsible for any loss, delay or damage caused by our inability to secure material, or by fire, strikes, lockouts, accidents, Government acts or requirements, embargoes, insurrections or riot, or by any cause beyond the reasonable control of ourselves or our suppliers.

3. An order cancelled prior to shipment will be subject to cancellation charges.

4. Terms: Net 30 days. Seller shall have the option of billing for partial shipments, or shipments delayed by Buyer, on a pro-rata basis. Quotations subject to acceptance within thirty (30) days from date thereof.

5. Prices quoted are F.O.B. Kitchener, transportation charges extra, unless otherwise stated. In cases where freight is allowed and so stated, it is prepaid only to the railway siding or truck terminal nearest to the destination. On freight-allowed shipments, the Company reserves the right to select the carrier or routing.

6. Prices on equipment of our manufacture are firm for shipments to be made within 12 months from date of quotation. For shipments to be made between 12 and 18 months from date of quotation, prices are subject to adjustment to our prices at time of shipment, with adjustment limited to 15% of the quoted price. For shipments to be made after 18 months from date of quotation, prices are to be adjusted to our prices at time of shipment.

7. Prices on equipment not of our manufacture, including equipment manufactured by Aerofin Corporation, are subject to adjustment by the same percentage of price change as may be made effective by our supplier prior to date of its shipment.

8. Federal and Provincial sales taxes are extra to the price shown, if applicable, unless specifically stated and shown for your convenience. If taxes are shown, they are calculated at present rates, and any increase in the tax base will be chargeable if effective before shipment is made.

9. Seller warrants that the goods shall be free of the rightful claim of any third person by way of patent infringement or the like and Seller will hold Buyer harmless against such claim, but, if Buyer furnishes the specifications then Buyer shall hold Seller harmless against any such claim which arises out of compliance with the specifications.

10. Shipments and deliveries shall at all times be subject to the approval of Seller's credit department.

11. Seller will replace at the original point of delivery material which upon inspection before installation is found defective or not in conformity with the applicable specifications, provided that notice has been given promptly of such defect or non-conformity and Seller is given a reasonable opportunity to inspect the same; but no claim shall be allowed by the Seller for the cost of any labour expended on such material, or for any separate special indirect or consequential damage to anyone. If Buyer does not give such notice the equipment shall be deemed to be in all respects in accordance with the contract.

12. Seller shall not be liable for any special, indirect, incidental, or consequential damages. The remedies of Buyer set forth herein are exclusive, and the liability of Seller with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, installation, or technical direction of installation repair or use of any equipment covered by or furnished under this contract whether in contract, in tort, or otherwise, shall not exceed the price of the equipment or part of which such liability is based.

13. Unless otherwise stated in the quotation, prices include one set of any contract drawing specified by the purchaser in his request for quotation. If additional drawings are needed or customer initiated changes are required they will be provided only upon receipt of a written order authorizing additional drawings.

14. Equipment required for nuclear applications – refer to Head Office for special terms.

WARRANTY

1. We warrant for a period not in excess of 18 months from date of shipment or 12 months from date of installation, whichever is earlier, the design, construction and materials of our products to be first-class, and free from defects in materials and workmanship. Our sole obligation under this Warranty is limited to repairing or furnishing, without charge, F.O.B. our Factory, any defective parts. We will not be responsible for damages of any nature, resulting from the above stated Warranty or from any defect in our products, either in materials, design, or construction, or arising from the use of such products. We do not guarantee against abrasion, corrosion or erosion.

2. THE ABOVE STATED WARRANTY, WHICH IS GIVEN EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, CONSTITUTES THE ONLY WARRANTY MADE BY SELLER.

3. Warranties on equipment not of our manufacture are limited to Terms of Warranty furnished by our suppliers.

SCHEDULE I - SCHEDULE OF PRICES

COOLING WATER PUMPS

1.	Pumps as described in the specification, FOB point of sale		
	a)	Circulating water pump	$ 1,851.00
	b)	Cooling water pump	$ 2,037.00
2.	Canadian Customs Duty _____ % of $ __________		$ Canadian made - no duty
3.	Transportation to site		$ 317.00
		TOTAL	$ 4,205.00

SCHEDULE II - TECHNICAL DATA

COOLING WATER PUMPS

1.0 SPECIFICATIONS

Manufacturer's name Canadian Blower/Canada Pumps Ltd.

Vendors name W. F. Keenan

	Circulating	Cooling Tower
Volume m^3/s	0.0075	0.0202
Discharge pressure kPa (g)	616.6	176.0
Inlet size mm	76.2	101.6
Discharge size mm	38.1	76.2
Drive type	Direct	Direct
Pump RPM	3500	1750
Motor		
- manufacturer	C.G.E.	C.G.E.
- power output	11.19 kW	5.595 kW
- speed	3500 rpm	1750 rpm
- enclosure type	TEFC	TEFC
- temperature rise	°C	°C
- frame size	254T	213T
Net weight	290 kg	308 kg
Overall dimensions	1321 x 381 x 530 mm	1146 x 305 x 667 mm

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order 1-1/2 months

TYPE - END SUCTION

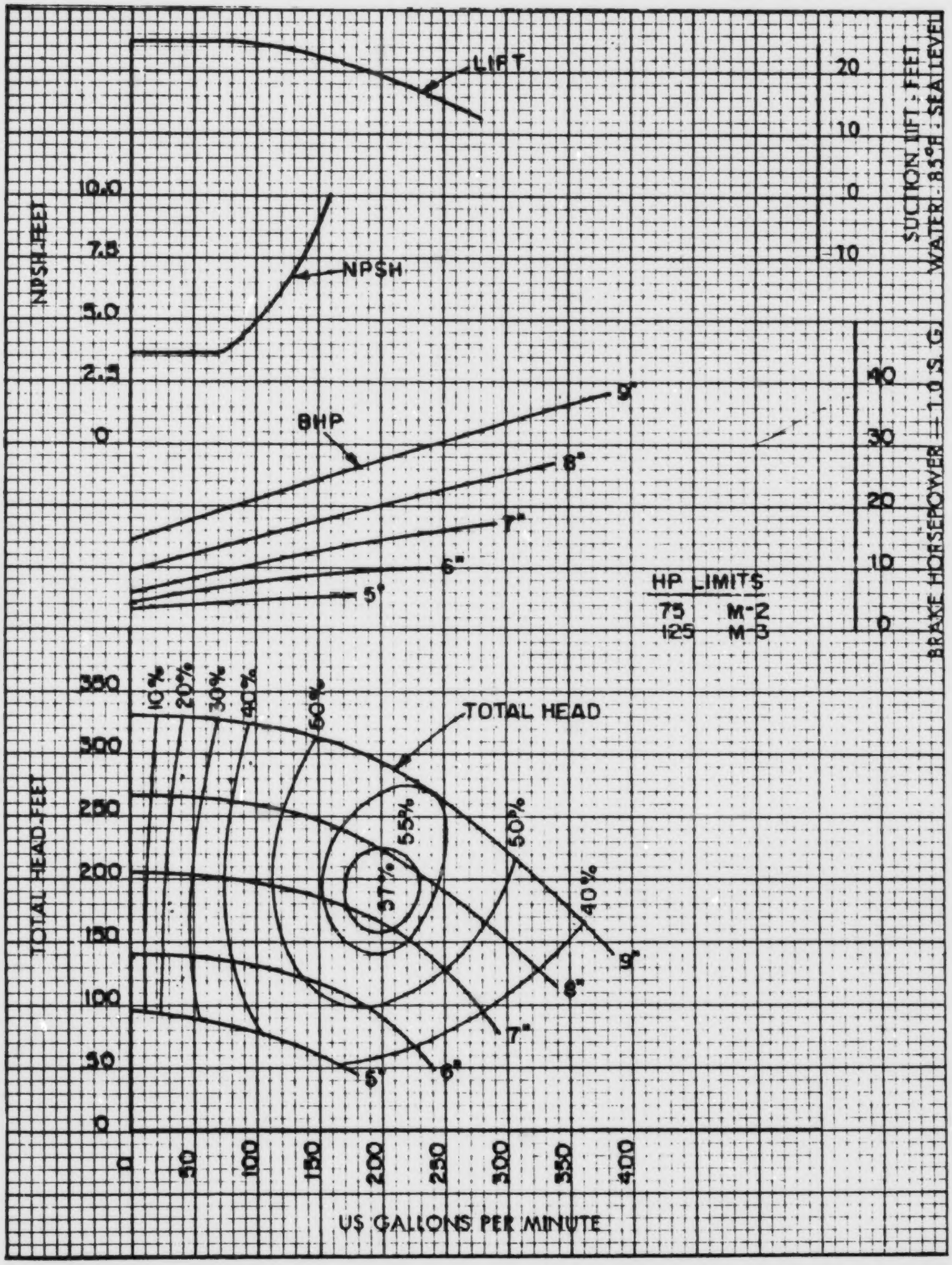
SIZE - 3 X 1½ X 9

IMPELLER PATT. G-2698

MODEL - A50 (509) CRO

RPM - 3500

DESIGN - OPEN



REFERENCE Z-180

Canadian Blower/Canada Pumps
LIMITED
KITCHENER, ONTARIO

PAGE - CPI-16

DATE OCT. 24/80

MODEL - 7011 CRO

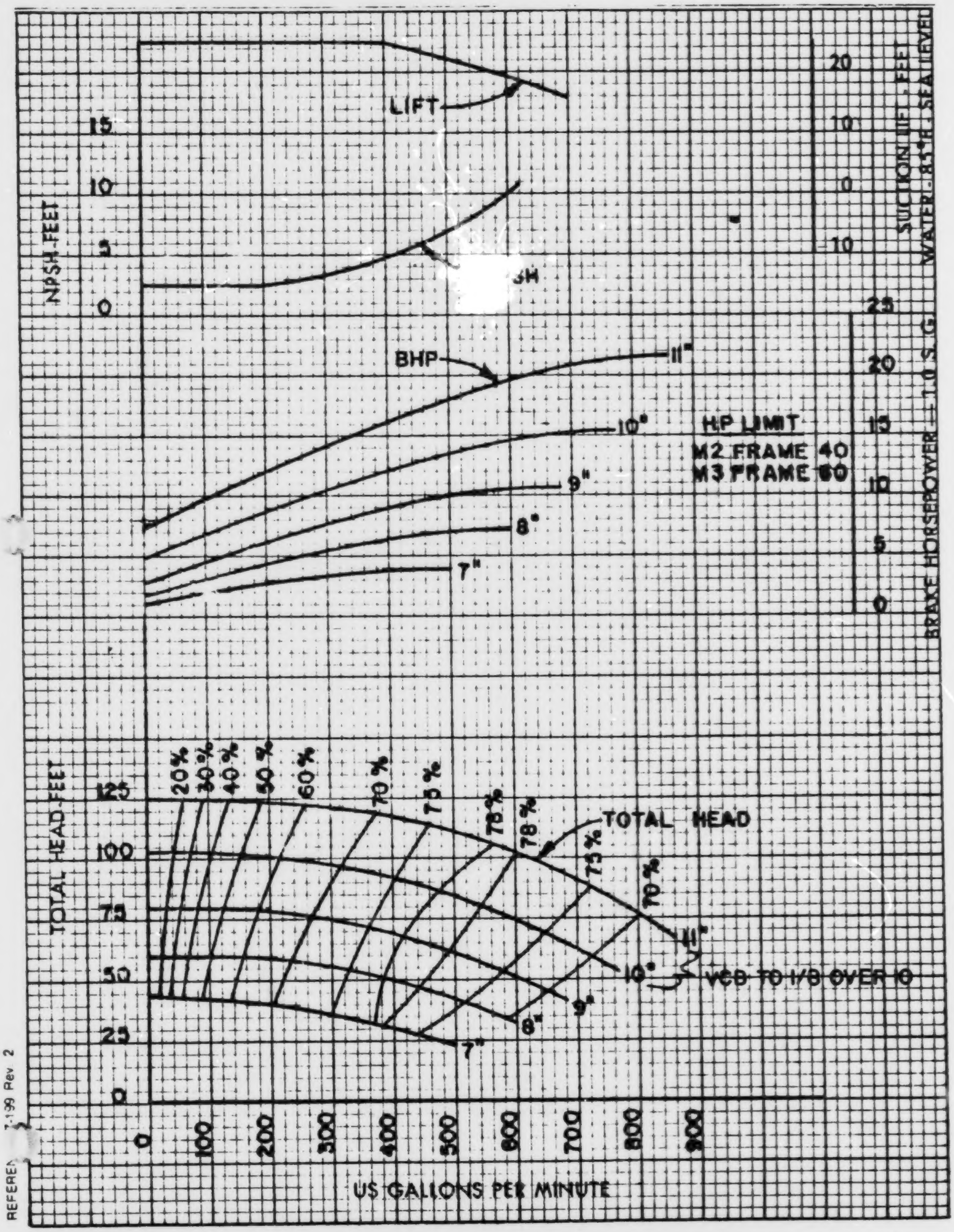
RPM - 1750

DESIGN - OPEN

TYPE - END SUCTION

SIZE - 4 X 3 X 11

IMPELLER PATT. G-3013



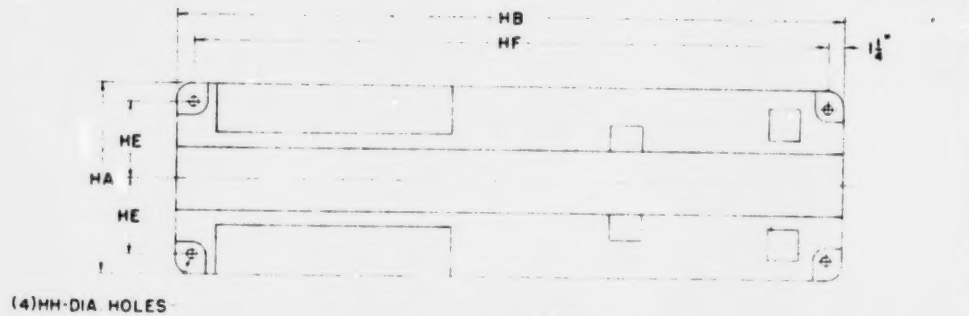
REFEREN 7-199 Rev 2

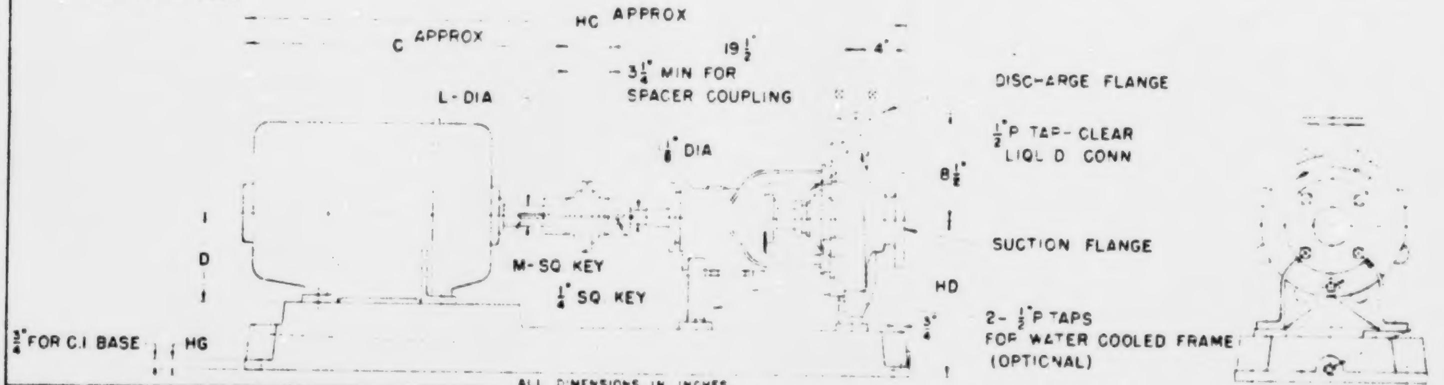
PAGE - CPI-50

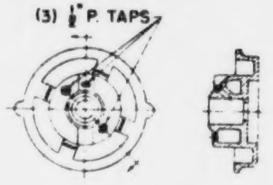
DATE OCT. 24/80

Canadian Blower/Canada Pumps
LIMITED
KITCHENER, ONTARIO

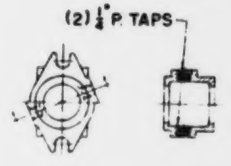
660533 A


HB
HF
1 1/4"
HE
HA
HE
(4)HH-DIA HOLES


C APPROX
HC APPROX
19 1/2"
4"
3 1/4" MIN FOR SPACER COUPLING
L-DIA
1/8" DIA
D
M-SQ KEY
1/4" SQ KEY
3/4" FOR C.I BASE
HG
DISC-ARGE FLANGE
1/2" P TAP-CLEAR LIQL D CONN
8 1/2"
SUCTION FLANGE
HD
3/4"
2- 1/2" P TAPS FOR WATER COOLED FRAME (OPTICNAL)
1/2" P TAP DRAIN IN CASING
1/2" P TAP-DRAIN FOR C I BASE ONLY



OPTIONAL WATER COOLED STUFFING BOX



OPTIONAL SPLIT QUENCH GLAND

ALL DIMENSIONS IN INCHES

DIM	143T	145T	182T	184T	213T	215T	254T	256T	284T	284TS	286T	286TS
HA	12	12	12	12	12	12	15	15	15	15	15	15
HB	45	45	45	45	45	45	52	52	52	52	52	52
C	12 1/8	13 1/8	14 3/4	15 3/4	18 1/8	19 5/8	21 13/16	23 9/16	24 9/16	23 3/16	26 1/16	24 11/16
D	3 1/2	3 1/2	4 1/2	4 1/2	5 1/4	5 1/4	6 1/4	6 1/4	7	7	7	7
HC	38 7/8	39 7/8	41 1/2	42 1/2	44 7/8	46 3/8	48 9/16	50 5/16	51 5/16	49 15/16	52 13/16	51 7/16
HD	12	12	12	12	12	12	12 3/8	12 3/8	12 3/8	12 3/8	12 3/8	12 3/8
HE	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	6	6	6	6	6	6
HF	42 1/2	42 1/2	42 1/2	42 1/2	42 1/2	42 1/2	49 1/2	49 1/2	49 1/2	49 1/2	49 1/2	49 1/2
HG	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
HH	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
L	7/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 7/8	1 5/8	1 7/8	1 5/8
M	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	1/2	3/8	1/2	3/8

DIM	324T	324TS	326T	326TS	364T	364TS	365T	365TS	404T	404TS	405T	405TS	444TS
HA	8	18	18	18	18	18	18	18	18	16	18	18	18
HB	58	58	58	58	58	58	58	58	60	60	60	60	60
C	27 3/16	25 11/16	28 11/16	27 3/16	33 1/4	31 1/8	34 1/4	32 1/8	37 3/8	34 3/8	38 7/8	35 7/8	39 1/16
D	8	8	8	8	9	9	9	9	10	0	10	10	11
HC	53 15/16	52 7/16	55 7/16	53 15/16	60	57 7/8	61	58 7/8	64 1/8	6 1/8	65 5/8	62 5/8	65 13/16
HD	13	13	13	13	14	14	14	14	15	5	15	15	16
HE	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
HF	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	57 1/2	57 1/2	57 1/2	57 1/2	57 1/2
HG	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/8
HH	1	1	1	1	1	1	1	1	1	1	1	1	1
L	2 1/8	1 7/8	2 1/8	1 7/8	2 3/8	1 7/8	2 3/8	1 7/8	2 7/8	2 1/8	2 7/8	2 1/8	2 3/8
M	1/2	1/2	1/2	1/2	5/8	1/2	5/8	1/2	3/4	1/2	3/4	1/2	5/8

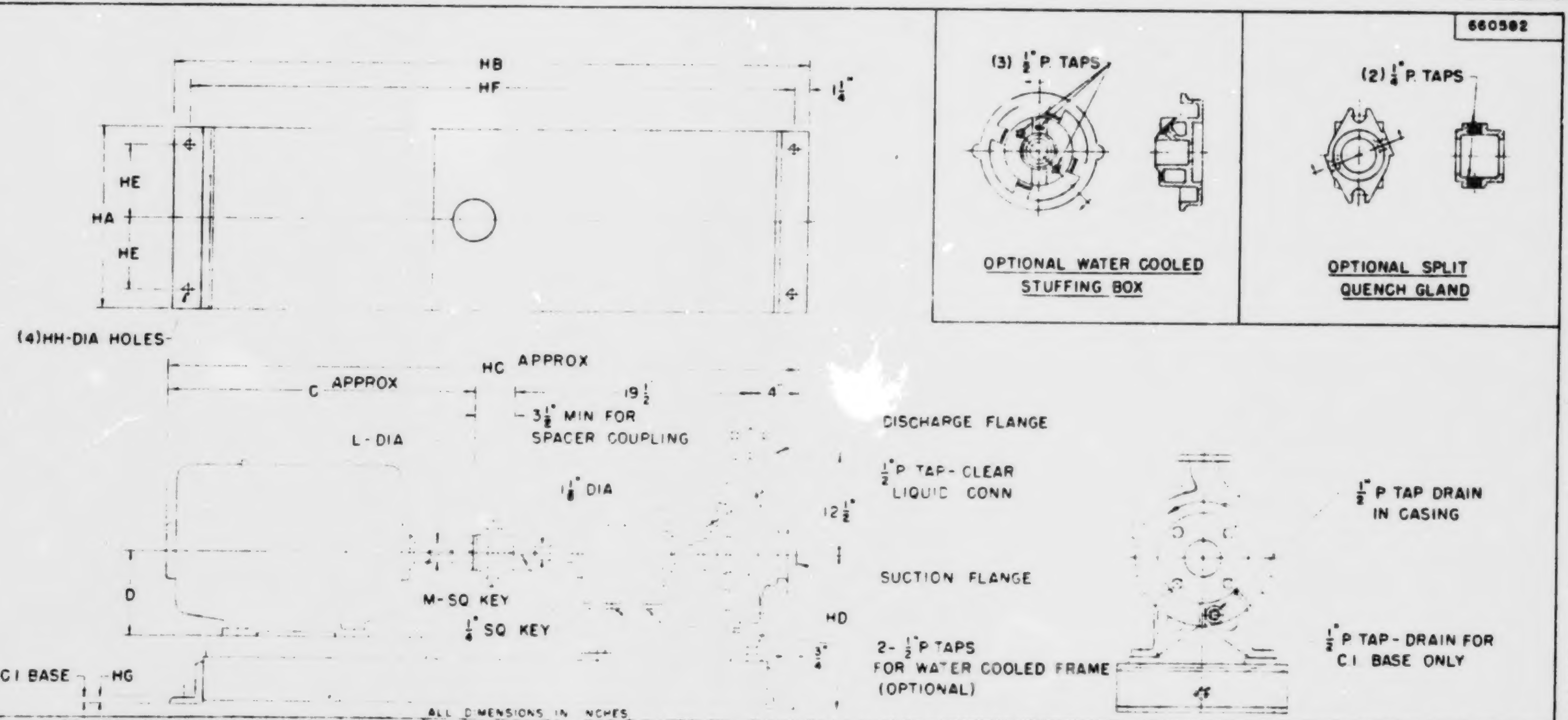
PUMP FLANGES	1 1/2 DISCHARGE		3" SUCTION	
	150#	300#	150#	300#
OUTSIDE DIA	5	6 1/8	7 1/2	8 1/4
BOLT CIRCLE	3 7/8	4 1/2	6	6 5/8
NO. & SIZE OF BOLTS	4 - 1/2	4 - 3/4	4 - 5/8	8 - 3/4
THICKNESS	9/16	13/16	3/4	1 1/8
DIA OF RAISED FACE	0	2 7/8	0	5
THK OF RAISED FACE	0	1/16	0	1/16

DRAWN BY - E G BRUBACHER DATE - NOV 5-69
CHK'D. BY - S WEICKER REV "A" MAR 9-72 H

Canadian Blower/Canada Pumps
LIMITED
KITCHENER, ONTARIO

TITLE -
1 1/2 x 3 CHEM-RATED PUMP AVS NO A50

DRAWING NO 660533 A


660582
HB
HF
$1\frac{1}{4}$"
HE
HA
HE
(4)HH-DIA HOLES
(3) $\frac{1}{2}$" P. TAPS
OPTIONAL WATER COOLED STUFFING BOX
(2) $\frac{1}{4}$" P. TAPS
OPTIONAL SPLIT QUENCH GLAND
HC APPROX
C APPROX
$19\frac{1}{2}$
4"
$3\frac{1}{2}$" MIN FOR SPACER COUPLING
L-DIA
$1\frac{1}{8}$" DIA
DISCHARGE FLANGE
$\frac{1}{2}$" P TAP-CLEAR LIQUID CONN
$12\frac{1}{2}$"
$\frac{1}{2}$" P TAP DRAIN IN CASING
SUCTION FLANGE
D
M-SQ KEY
$\frac{1}{4}$" SQ KEY
HD
$\frac{3}{4}$"
2-$\frac{1}{2}$" P TAPS FOR WATER COOLED FRAME (OPTIONAL)
$\frac{1}{2}$" P TAP-DRAIN FOR C I BASE ONLY
$\frac{3}{4}$" FOR C I BASE
HG

ALL DIMENSIONS IN INCHES

DIM	143T	145T	182T	184T	213T	215T	254T	256T	284T	284TS	286T	286TS	324T	324TS	326T	326TS	364T	364TS	365T	365TS	404T	404TS	405T	405TS	444TS
HA	12	12	12	12	12	12	15	15	15	15	15	15	18	18	18	18	18	18	18	18	18	18	18	18	18
HB	45	45	45	45	45	45	52	52	52	52	52	52	58	58	58	58	58	58	58	58	60	60	60	60	60
C	12 1/8	13 1/8	14 3/4	15 3/4	18 1/8	19 5/8	21 13/16	23 9/16	24 9/16	23 3/16	26 1/16	24 1/16	27 3/16	25 11/16	28 11/16	27 3/16	33 1/4	31 1/8	34 1/4	32 1/8	37 3/8	34 3/8	38 7/8	35 7/8	39 1/16
D	3 1/2	3 1/2	4 1/2	4 1/2	5 1/4	5 1/4	6 1/4	6 1/4	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11
HC	[illegible]	[illegible]	41 3/4	42 3/4	45 1/8	46 5/8	48 9/16	50 5/16	51 9/16	[illegible]	53 1/16	[illegible]	54 7/16	[illegible]	[illegible]	54 3/16	[illegible]	[illegible]	[illegible]	[illegible]	64 3/8	[illegible]	65 7/8	62 7/8	[illegible]
HD	13 3/4	13 3/4	13 3/4	13 3/4	13 3/4	13 3/4	14 1/8	14 1/8	14 1/8	14 1/8	14 1/8	14 1/8	14 3/4	14 3/4	14 3/4	14 3/4	14 3/4	14 3/4	14 3/4	14 3/4	15	15	15	15	16
HE	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	6	6	6	6	6	6	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
HF	42 1/2	42 1/2	42 1/2	42 1/2	42 1/2	42 1/2	49 1/2	49 1/2	49 1/2	49 1/2	49 1/2	49 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	55 1/2	57 1/2	57 1/2	57 1/2	57 1/2	57 1/2
HG	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
HH	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1	1	1	1	1	1	1	1
L	7/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 7/8	1 5/8	1 7/8	1 5/8	2 1/8	1 7/8	2 1/8	1 7/8	2 3/8	1 7/8	2 3/8	1 7/8	2 7/8	[illegible]	2 7/8	2 1/8	2 3/8
M	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	1/2	3/8	1/2	3/8	1/2	1/2	1/2	1/2	5/8	1/2	5/8	1/2	3/4	1/2	3/4	1/2	5/8

PUMP FLANGES	3" DISCHARGE		4" SUCTION	
	150#	300#	150#	300#
OUTSIDE DIA	7 1/2	8 1/4	9	10
BOLT CIRCLE	6	6 5/8	7 1/2	7 7/8
NO & SIZE OF BOLTS	4 - 5/8	8 - 3/4	8 - 5/8	8 - 3/4
THICKNESS	15/16	1 1/8	15/16	1 1/4
DIA OF RAISED FACE	0	5	0	6 3/16
THK OF RAISED FACE	0	1/16	0	1/16

DRAWN BY - J.E.WALKER
CHK'D BY - F.COOPER
DATE - SEPT 20/78
REV

Canadian Blower/Canada Pumps
LIMITED
KITCHENER, ONTARIO

TITLE -
3 x 4 CHEM-RATED PUMP AVS NO 7011

DRAWING NO 6605R2

FLECK BROS. LIMITED
SERVICE TO INDUSTRY SINCE 1907
3137 GRANDVIEW HWY., VANCOUVER, B.C. V5M 2E9
PHONE 430-1311 • TELEX 04-53380

QUOTATION

153-2
BROCHURE INCL.

WHEN ORDERING PLEASE REFER TO THIS QUOTATION NUMBER AND DATE BELOW.

PC 1626

DIVISION
PUMP & COMPRESSOR

DATE
December 7, 1983.

PROPOSAL TO

Integ Limited,
1155 West Pender Street,
Vancouver, B.C.
V6E 2P4

ENGINEERING & APPLICATION ASSISTANCE

- PUMP REPAIRS
- PUMP REPAIR PARTS
- COMPRESSOR REPAIRS
- COMPRESSOR REPAIR PARTS
- FIELD SERVICE
- SYSTEMS PACKAGING

Attention: Mr. G.R. (Grant) Cooper, P. Eng.
Projecet Manager

WE PROPOSE TO SUPPLY THE FOLLOWING DESCRIBED PRODUCTS AT THE PRICES QUOTED, SUBJECT TO THE TERMS AND CONDITIONS NOTED HEREON. WE WILL MAKE EVERY EFFORT TO MAINTAIN DELIVERY AS QUOTED BUT CANNOT GUARANTEE SHIPPING DATES. THIS PROPOSAL IS SUBJECT TO ACCPETANCE WITHIN 30 DAYS UNLESS OTHERWISE NOTED.

Reference: Energy Mines and Resources Canada
Combustion Research Facility
Circulating and Cooling Tower Pumps
Your File 0243-E1

Dear Sir:

We are in receipt of your inquiry with specifications as referenced above, for which many thanks.

Please find attached herewith descriptive literature along with typical performance curves, dimension prints, and supporting technical data covering suitable equipment as manufactured by our principals, Worthington (Canada) Limited.

Technical Requirements: 4.0

Please note that pumps offered herein are of the horizontal end suction, vertical discharge design with a maximum noise level of 83 dba at the distance specified, while motors supplied will be 575 volt, 3 phase, 60 cycle TEFC.

Standards and Codes: 5.0

Equipment offered herein is manufactured to ANSI and ASME Codes.

Warranty: 6.0

Equipment offered herein is warranteed as outlined in this clause.

Drawings and Manuals: 7.0

General arrangement drawings attached herewith as required.

continued ....

HE PRICES QUOTED HEREIN ARE BASED UPON EXISTING FACTORY PRICES, RATES OF EXCHANGE, DUTIES, TAXES AND FREIGHT. UNLESS OTHERWISE NOTED THESE PRICES ARE JBJECT TO ADJUSTMENT IN THE EVENT OF CHANGES, AND GOODS WILL BE INVOICED AT PRICES PREVAILING AT THE TIME OF SHIPMENT.

ORDERS COVERING SPECIAL GOODS ARE NOT SUBJECT TO CANCELLATION, NOR CAN SPECIAL GOODS BE RETURNED FOR CREDIT. LIABILITY IN THE CASE OF DEFECTIVE GOODS IS LIMITED BY THE MANUFACTURER'S WARRANTY TO THE VALUE OF SUCH DEFECTIVE GOODS ONLY. NO LIABILITY CAN BE ACCEPTED FOR DELAYS OR NON-DELIVERY DUE TO ACCIDENTS, STRIKES, FIRES, OR OTHER CAUSES BEYOND OUR CONTROL.

CONTINUATION OF QUOTATION No. PC 1626 DATED December 7, 1983.

TO: Integ Limited
Mr. G.R. Cooper, P. Eng.

Drawings and Manuals: (cont'd)

Certified dimension prints will be submitted prior to shipment of the pumps and motors, etc.

For your consideration, therefore, we offer:

CIRCULATING PUMPS:

2 only WORTHINGTON (CANADA) LIMITED Type D-814 Size 2½ x 1½ x 8 standard fitted heavy duty end suction centrifugal pumps fitted with close grained cast iron casing, bronze enclosed impeller, steel shaft and John Crane single mechanical seal, etc., generally as illustrated and described in the attached bulletin.

Pump driven through flexible coupling by a 15 HP, 3500 RPM totally enclosed fan-cooled motor all mounted on extended fabricated steel baseplate with coupling guard.

PRICE EACH --$1,629.00 EACH NET

COOLING TOWER PUMP:

2 only WORTHINGTON (CANADA) LIMITED Type D-814 Size 4 x 3 x 8 heavy duty end suction centrifugal pumps as described above each driven through flexible coupling by a 7½ HP 1800 RPM totally enclosed fan-cooled motor supplied c/w extended fabricated steel baseplate, coupling and coupling guard.

PRICE EACH --$1,758.00 EACH NET

Prices indicated herein are:

F.O.B. Site
Federal & Provincial Taxes EXTRA, if applicable
Shipment: 6 to 8 weeks after receipt of your formal purchase order

continued ....

TO: Integ Limited
Mr. G.R. Cooper, P. Eng.

We trust the foregoing is in complete accordance with your requirements and that we might have the pleasure of working with you further in this regard.

Yours very truly,

FLECK BROS. LIMITED

G. Thompson, Manager
Pump & Compressor Division.

GT/cr
enclosures

SCHEDULE II - TECHNICAL DATA

COOLING WATER PUMPS

1.0 SPECIFICATIONS

Manufacturer's name: WORTHINGTON (CANADA) LIMITED

Vendors name: FLECK BROS. LIMITED

	Circulating		Cooling Tower	
Volume m^3/s USGPM	120		320	
Discharge pressure kPa (g) ft.	205		59	
Inlet size(mm) "	2-1/2"		4"	
Discharge size(mm)"	1-1/2"		3"	
Drive type	Coupling		Coupling	
Pump RPM	3500		1750	
Motor				
- manufacturer	C.G.E.		C.G.E.	
- power output	15 HP	kW	7-1/2	kW
- speed	3500	rpm	1750	rpm
- enclosure type	TEFC		TEFC	
- temperature rise	40	°C	40	°C
- frame size	2547		213 T	
Net weight (total)	610	~~Kg~~ lbs.	740	~~Kg~~ lbs.
Overall dimensions	See Attached Drawings	mm	See Attached Drawings	mm

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order: 6 to 8 weeks ~~months~~

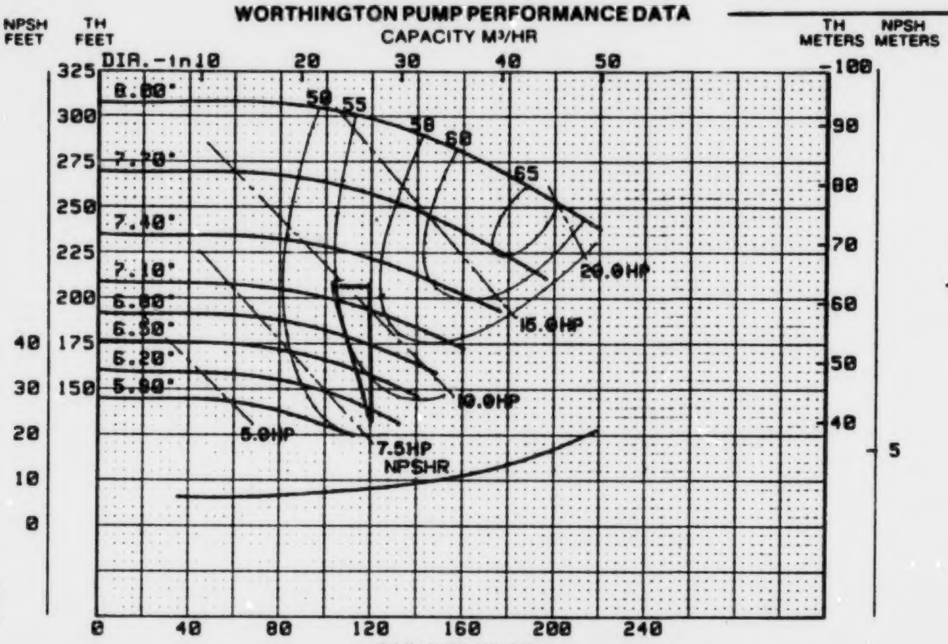
2012-8 Page 14
October 1983
Original
2½ x 1½ x 8 D-800
60 CYCLE
CLOSED IMPELLER

Customer ____________________ Worthington S.O. ____________________
Project ____________________ Proposal/Order No. ____________________
Cust. Proposal/Order No. ____________________ Certified By ____________________
Customer Item No. ____________________ Date ____________________

Liquid/Service __________ Sp. Gr. __________ Visc. __________ SSU
Capacity __________ Head __________ Temp. __________ °F /°C Consistency __________ %

CIRCULATING WATER

WORTHINGTON PUMP PERFORMANCE DATA

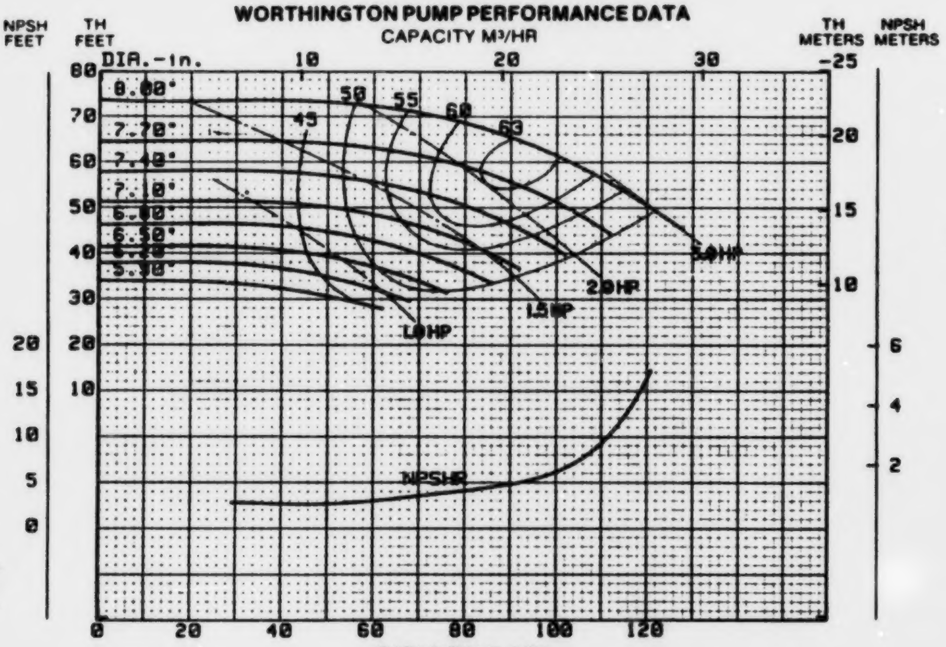


MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
D-800	2.5x1.5x8	3550	A-19464	.44 dia

SP GR 1.0
FOR MOTORS WITH 1.15 S.F.

MOTOR SIZE	IMP. DIA.
20	8
15	7.50
10	6.90
7.5	6.10
5	–

WORTHINGTON PUMP PERFORMANCE DATA



MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
D-800	2.5x1.5x8	1730	A-19465	.44 dia

SP GR 1.0
FOR MOTORS WITH 1.15 S.F.

MOTOR SIZE	IMP. DIA.
3	8
2	7.50
1.5	7.10
1	6.20

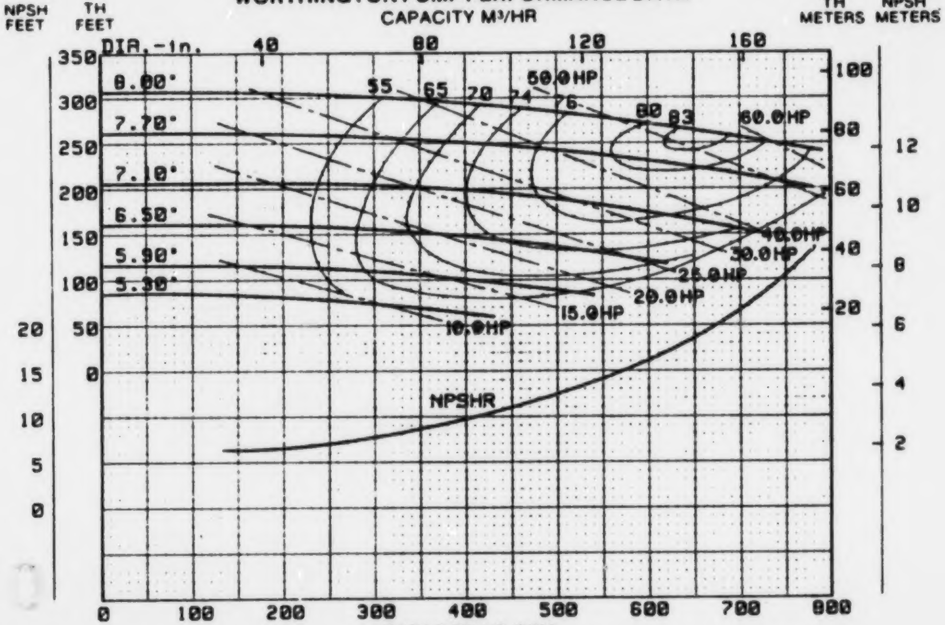
Litho'd. in U.S.A.

2012-8 Page 16
October 1983
Original
3 x 8 D-800
CYCLE
CLOSED IMPELLER

Customer ____________ Worthington S.O. ____________
Project ____________ Proposal/Order No. ____________
Cust. Proposal/Order No. ____________ Certified By ____________
Customer Item No. ____________ Date ____________

Liquid/Service ____________ Sp. Gr. ____________ Visc. ____________ SSU
Capacity ____________ Head ____________ Temp. ____________ °F/°C Consistency ____________ %

WORTHINGTON PUMP PERFORMANCE DATA

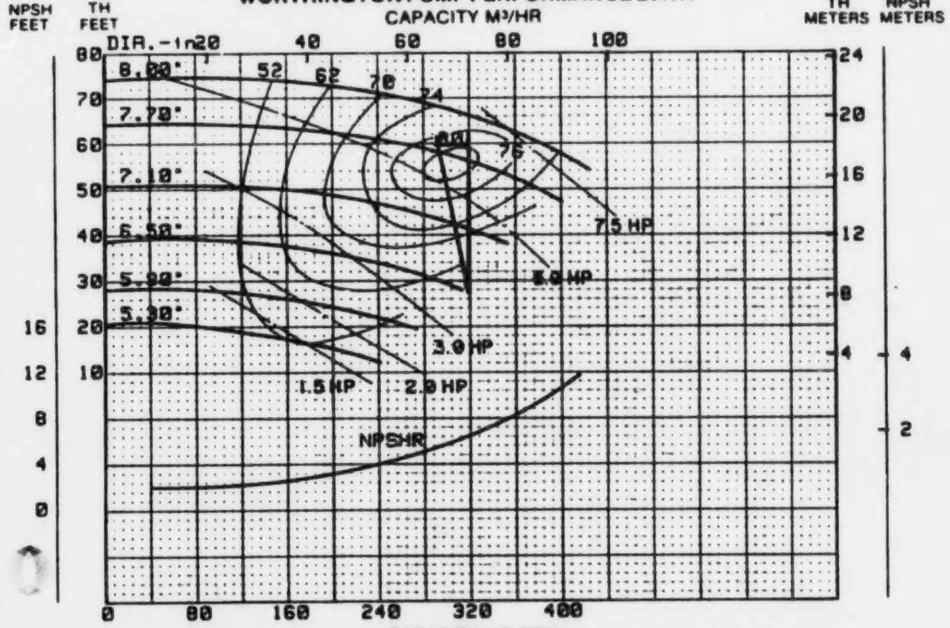


MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
D-800	4x3x8	3550	A-19468	.63 dia

SP GR 1.0
FOR MOTORS WITH 1.15 S.F.

MOTOR SIZE	IMP. DIA.
60	8
50	7.70
40	7.20
30	6.90
25	6.50
20	6.20
15	5.80
10	5.30

WORTHINGTON PUMP PERFORMANCE DATA



MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
D-800	4x3x8	1750	A-19469	.63 dia

SP GR 1.0
FOR MOTORS WITH 1.15 S.F.

MOTOR SIZE	IMP. DIA.
7.5	8
5	7.30
3	6.10
2	5.60

COOLING TOWER

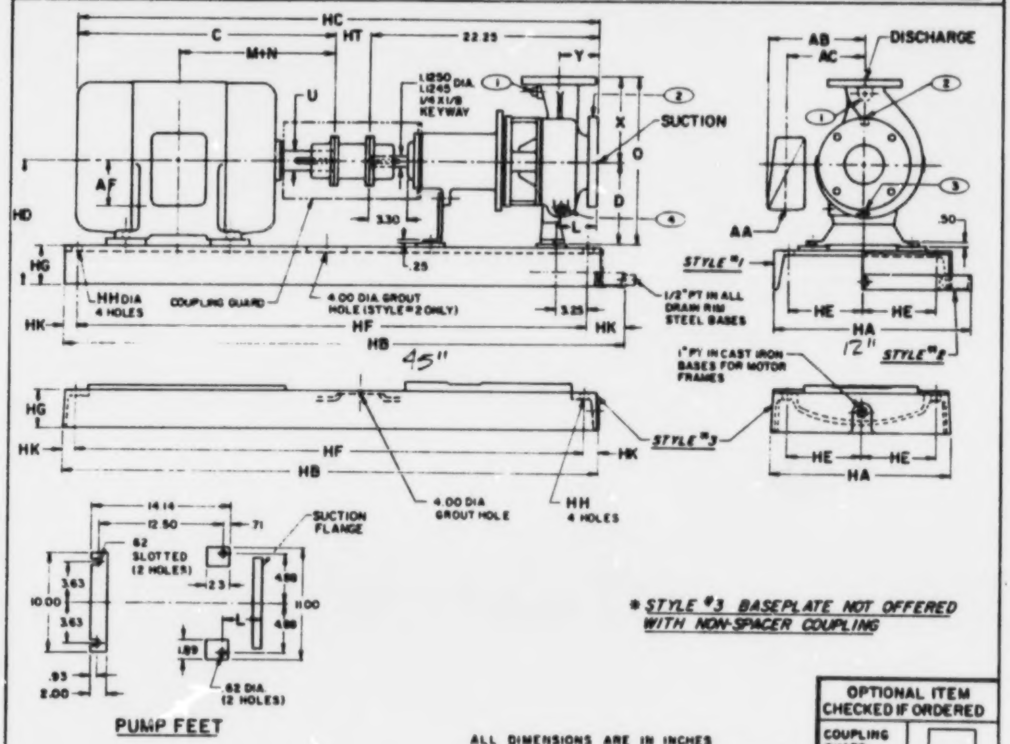
Litho'd. in U.S.A.

WORTHINGTON PUMP

Worthington

CENTRIFUGAL PUMP
D-814 LINE

FRAME B
4×3×8
6×4×8


HC
C
M+N
HT
22.25
Y
U
1.1250
1.1245 DIA.
1/4×1/8 KEYWAY
SUCTION
X
O
D
AF
HD
3.30
L
.25
HG
HH DIA 4 HOLES
COUPLING GUARD
4.00 DIA GROUT HOLE (STYLE #2 ONLY)
3.25
.23
1/2" PT IN ALL DRAIN RIM STEEL BASES
HK
HF
HB
45"
AB
AC
DISCHARGE
AA
.50
STYLE #1
HE
HA
12"
STYLE #2
1" PT IN CAST IRON BASES FOR MOTOR FRAMES
STYLE #3
4.00 DIA GROUT HOLE
HH 4 HOLES
14.14
12.50
.71
SUCTION FLANGE
.62 SLOTTED (2 HOLES)
3.63
10.00
2.3
4.50
11.00
1.89
.93
2.00
.62 DIA. (2 HOLES)
①
②
③
④

PUMP FEET

* *STYLE #3 BASEPLATE NOT OFFERED WITH NON-SPACER COUPLING*

ALL DIMENSIONS ARE IN INCHES

OPTIONAL ITEM CHECKED IF ORDERED	
COUPLING GUARD	☐

⊗ *SUCTION FLANGE ON PUMP HAS (8) 3/4-10×1.09 DEEP TAPPED HOLES ON 9.50 DBC*

PUMP	150# FF FLG		D	O	L	X	Y	APPROX. WT. OF PUMP LBS	SIZE OF CASING CONNECTIONS LOCATION-SEE DRAWING ABOVE NA INDICATES NOT AVAILABLE			
	SUCT	DISCH							①	②	③	④
4×3×8	4	3	8.25	19.25	4.00	11.00	4.00	177	1/2		1/2	NA
6×4×8	6⊗	4		19.25		11.00		204	1/2		NA	1/2

SPACER COUPLING		NON-SPACER COUPLING	
MFR/MODEL/SIZE	HT	MFR/MODEL/SIZE	HT
	3.50		

BASEPLATE SELECTIONS

STYLE	DESCRIPTION
#1	CHANNEL STEEL
#2	CHANNEL STEEL DRAIN RIM
#3 *	CAST IRON WITH DRIP LIP

BASEPLATE DIMENSIONS

MOTOR FRAMES	STYLE NO	HA	HB	HD		HE	HF	HG	HH	HK	APPROX. WT LBS.
143T THRU 215T	1	12.00	45.00	11.25	⊗ NOTE FRAME 286TS ONLY	4.50	42.50	3.00	.75	1.25	79
	2	16.50	50.00	11.44		4.50	42.50	3.19	.75	3.25	130
	3	12.00	45.00	12.00		4.50	47.50	2.88	.75	1.25	170
254T 256T 284T,TS	1	15.00	52.00	11.65		6.00	49.50	3.40	.75	1.25	147
	2	19.25	57.00	11.81		6.00	49.50	3.56	.75	3.25	230
	3	15.00	52.00	12.37		6.00	49.50	3.38	.75	1.25	230
286T,TS⊗ 324T,TS 326T,TS	1	18.00	58.00	⊗12.75	12.25	7.50	55.50	4.00	1.00	1.25	206
	2	21.88	63.00	⊗12.89	12.39	7.50	55.50	4.14	1.00	3.25	305
	3	18.00	58.00	⊗13.00	13.00	7.50	55.50	3.88	1.00	1.25	290
364T,TS 365T,TS	1	18.00	58.00	13.75		7.50	55.50	4.00	1.00	1.25	206
	2	21.88	63.00	13.89		7.50	55.50	4.14	1.00	3.25	305
	3	18.00	58.00	14.00		7.50	55.50	3.88	1.00	1.25	290
	FOR MOTOR FRAMES 404TS, 404T, 405TS, 405T, 444TS AND 444T SEE RW180961										

MOTOR DATA				DIMENSIONS	
MFR				HC	
TYPE	-			C	
FRAME				M+N	
HP				U	
RPM				AA	
PHASE		HZ		AB	
VOLTS				AC	
APPROX. WT. LBS.				AF	

CUSTOMER ____________ CUSTOMERS ORDER ____________ ITEM ____________

DISTRICT OFFICE ____________ OUR SHOP ORDER ____________ CERTIFIED BY ____________ DATE ____________

THIS PRINT IS LOANED SUBJECT TO RETURN ON DEMAND AND UNDER CONDITION THAT IT IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST. DO NOT SCALE, ADDITIONAL DIMENSIONS WILL BE FURNISHED UPON REQUEST. THIS PRINT IS FOR PRELIMINARY USE UNLESS ABOVE SPACES ARE FILLED DIMENSIONS ARE FROM DRAWINGS, CASTINGS MAY VARY SLIGHTLY. FOUNDATION BOLTS MUST NOT BE FIXED RIGIDLY UNTIL MACHINE IS IN PLACE.

WORTHINGTON DIVISION, McGRAW-EDISON COMPANY
East Orange, New Jersey 07017

DIMENSION SHEET
RW-180978

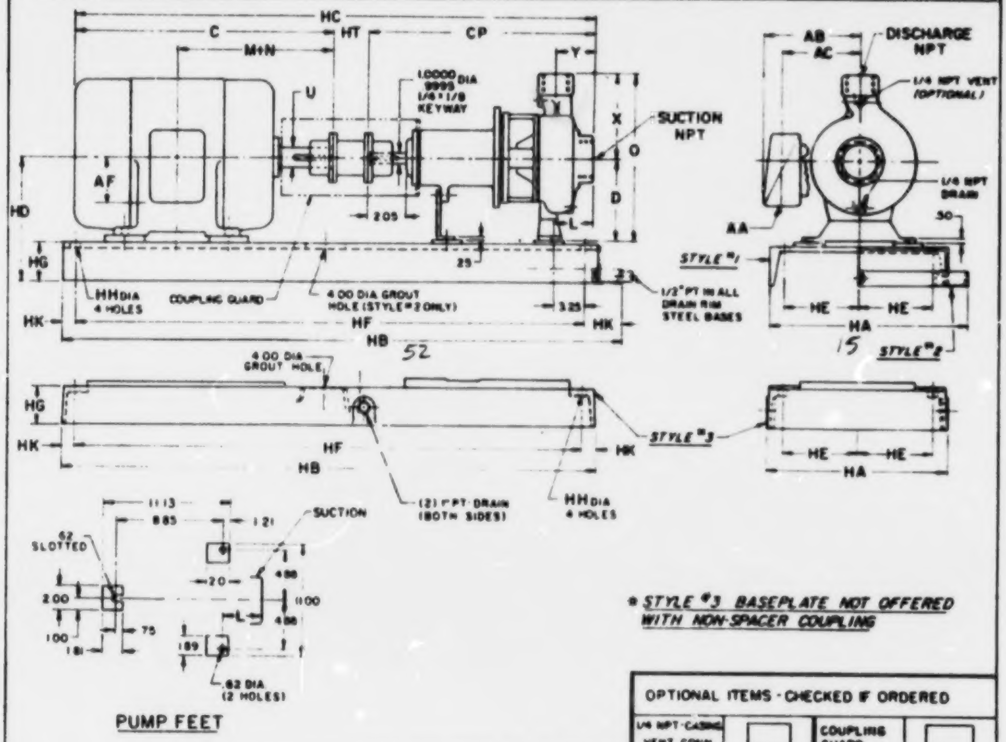
TYPE D-800
ELEVATIONS

ELEVATIONS

Worthington

CENTRIFUGAL PUMP
D-814 LINE

FRAME A
3×2×6 2½×1½×8
2×1×8 3×2×8


HC
C
HT
CP
M+N
Y
U
1.0000 DIA
.9995
1/4×1/8 KEYWAY
X
SUCTION NPT
O
AF
D
HD
2.05
L
HG
.25
HH DIA
4 HOLES
COUPLING GUARD
4.00 DIA GROUT HOLE (STYLE #2 ONLY)
3.25
.25
1/2" PT IN ALL DRAIN RIM STEEL BASES
HK
HF
HK
HB
52
AB
AC
DISCHARGE NPT
1/4 NPT VENT (OPTIONAL)
1/4 NPT DRAIN
AA
.50
STYLE #1
HE
HE
HA
15
STYLE #2
4.00 DIA GROUT HOLE
HG
HK
HF
HB
(2) 1" PT DRAIN (BOTH SIDES)
HK
HH DIA
4 HOLES
STYLE #3
HE
HE
HA
11.13
8.85
1.21
SUCTION
.62 SLOTTED
2.00
1.00
1.81
.75
2.0
4.90
11.00
4.90
L
1.89
.62 DIA (2 HOLES)
PUMP FEET

STYLE #3 BASEPLATE NOT OFFERED WITH NON-SPACER COUPLING

ALL DIMENSIONS ARE IN INCHES

PUMP	NAT'L PIPE THD		CP	D	O	L	X	Y			APPROX WT OF PUMP-LBS
	SUCT	DISCH									
3×2×6	3	2	18.54	7.00	15.70	3.87	8.70	3.17			96
2×1×8	2	1	17.93		15.50	3.27	8.50	2.77			84
2-½×1-½×8	2-½	1-½	18.07		15.50	3.41	8.50	2.85			90
3×2×8	3	2	18.55		17.50	3.89	10.50	3.25			106

BASEPLATE DIMENSIONS										APPROX WT LBS
MOTOR FRAMES	STYLE NO	HA	HB	HD	HE	HF	HG	HH	HK	
56,143T THRU 184T	1	12.00	39.00	10.00	4.50	36.50	3.00	.75	1.25	67
	2	16.50	44.00	10.19	4.50	36.50	3.19	.75	3.75	125
	3	12.00	39.00	10.25	4.50	36.50	2.75	.75	1.25	170
213T 215T	1	12.00	39.00	10.00	4.50	36.50	3.00	.75	1.25	147
	2	16.50	44.00	10.19	4.50	36.50	3.19	.75	3.75	230
	3	12.00	39.00	10.25	4.50	36.50	2.75	.75	1.25	230
254T 256T	1	15.00	52.00	10.40	6.00	49.50	3.40	.75	1.25	147
	2	19.25	57.00	10.56	6.00	49.50	3.56	.75	3.75	230
	3	15.00	52.00	11.62	6.00	49.50	3.38	.75	1.25	230

OPTIONAL ITEMS - CHECKED IF ORDERED

1/4 NPT-CASING VENT CONN	☐	COUPLING GUARD	☐

SPACER COUPLING		NON-SPACER COUPLING	
MFR/MODEL/SIZE	HT	MFR/MODEL/SIZE	HT
	3.50		

BASEPLATE SELECTIONS

STYLE	DESCRIPTION
#1	CHANNEL STEEL
#2	CHANNEL STEEL DRAIN RIM
#3 *	CAST IRON WITH DRIP LIP

MOTOR DATA				DIMENSIONS	
MFR				HC	
TYPE				C	
FRAME				M+N	
HP				U	
RPM				AA	
PHASE		HZ		AB	
VOLTS				AC	
APPROX. WT. LBS.				AF	

CUSTOMER________ CUSTOMERS ORDER________ ITEM________

DISTRICT OFFICE________ OUR SHOP ORDER________ CERTIFIED BY________ DATE________

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WORTHINGTON DIVISION, McGRAW-EDISON COMPANY
East Orange, New Jersey 07017

DIMENSION SHEET
RW-180958

153-3
COOLING TOWER SUMP

BIDDER'S LIST

COOLING TOWER SUMP (153-3)

Burrard Yarrows Corporation
109 E. Esplanade
North Vancouver, B.C.
988-2111

Ebco Industries Ltd.
7851 Alderbridge Way
Richmond, B.C.
278-5578

Attn: Mr. Mark Patterson

W.A. Thom Ltd.
245 Fell
North Vancouver, B.C.
980-3477

ebco

EBCO INDUSTRIES LTD.

P.O. BOX 94200, V6Y 2A5
7851 ALDERBRIDGE WAY
RICHMOND, B.C. V6X 2A4
CANADA

TELEPHONE (604) 278-5578
TELEX 043-55619

mteg
DEC 12 1983

December 7, 1983.

Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, British Columbia.

Attention: Mr. G. R. Cooper, P. Eng.,
Project Manager.

Dear Mr. Cooper:

RE: File 0243-E1,
Ebco Quote No. 845.

Thank you for the above referenced enquiry. In our opinion the most cost effective method of building the vessel described by your specifications considering the small size, low temperature and need to avoid corrosion would be to make it from T304 stainless steel. Accordingly, please find enclosed your completed schedule of prices and technical data.

The price shown is F.O.B. our plant, all applicable taxes extra. The freight cost would depend upon the method of transportation.

Yours very truly,

EBCO INDUSTRIES LTD.,

M. R. Patterson

Mark R. Patterson, P. Eng.

MRP/pgn

Encls.

FABRICATING • MACHINING • DIES • MOULDS • ENGRAVING • METAL STAMPING • PLATING • POLISHING • HOT DIP GALVANIZING • CUSTOM MACHINERY • MACHINERY REPAIRS • STORE FIXTURES • POLE LINE HARDWARE • BUILDERS HARDWARE

SCHEDULE I - SCHEDULE OF PRICES

COOLING TOWER SUMP

1.	Cooling tower sump as described in the specification, FOB point of sale	$ 7,482.00
2.	Canadian Customs Duty _____ % of $ __________	$ -
3.	Transportation to site	$ -
	TOTAL	$ -

SCHEDULE II - TECHNICAL DATA

COOLING TOWER SUMP

1.0 SPECIFICATIONS

Manufacturer's name	EBCO INDUSTRIES LTD.	
Vendors name	EBCO INDUSTRIES LTD.	
Tank shell material	T304 Stainless Steel	
Shell thickness	2.11	mm
Type of coating	None.	
Thickness of coating	-	mm
Anchor bolt diameter	19	mm
Total weight	466	kg

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order	8	weeks

153-3

FROM
REGAL TANKS LTD., BOX 289 SURREY B.C.

DEPARTMENT

SEND TO

INTEG. INTERCONTINENTAL ENG., LTD.,
1155 W. PENDER ST.,
VANC. B.C. V6E-2P4.

DATE 19 DEC. 83

SUBJECT FILE: 0243 - E1.

MESSAGE

ATTN; G.R. COOPER.

RE; FILE 0243 - E1

PLEASE FIND ATTACHED A COPY OF REQUESTED. COST ESTIMATE.

integ
DEC 22 1983

CIRC.	DATE
G.C.	

FILE

YOURS TRULY

LARRY FELL
ph. 580-9733

USE LOWER PORTION FOR REPLY

REPLY FROM

DATE

SCHEDULE II - TECHNICAL DATA

COOLING TOWER SUMP

1.0 SPECIFICATIONS

Manufacturer's name REGAL TANKS LTD.

Vendors name REGAL TANKS LTD.

Tank shell material 283 GR C

Shell thickness 4.76 mm

Type of coating Copon 25C Epoxy Mastic

Thickness of coating .25 mm

Anchor bolt diameter 1880 mm

Total weight 764 kg

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3 weeks

SCHEDULE I - SCHEDULE OF PRICES

COOLING TOWER SUMP

1.	Cooling tower sump as described in the specification, FOB point of sale	$ 3,944.00
2.	Canadian Customs Duty _____ % of $ __________	$ N/A
3.	Transportation to site (approximately)	$ 660.00
	TOTAL	$ 4,604.00

Price is Federal Sales Tax included.
Provincial Sales Tax is extra if applicable.
Price is net 30 days on approved credit.
Quote is firm 30 days.

153-3

EST. 1934

W.A.THOM (1983) LTD.

245 FELL AVENUE - NORTH VANCOUVER, B.C. V7P 2K1 - TELEPHONE 980-3477 - TELEX 04-352720

TO: Intercontinental Engineering Ltd.,
1155 West Pender St.,
Vancouver, B.C.
V6E 2P4

DATE: December 9, 1983

ON.: MJ/524/83

integ
DEC 12 1983
DATE
GRC

OUR TENDER RE: One only Clean Water Sump Tank

Attn: G.R. Cooper

We submit the following quotation in accordance with the terms listed below:

ITEM

DESCRIPTION

Gentlemen,

We are pleased to offer our price as per the above noted project.

To fabricate one only Clean Water Sump Tank 1830 mm diameter x 1780mm high, fabricated from carbon steel plate, 3/16" thick for shell and top, 1/4" thick for bottom, complete with fittings one through fourteen shown on your sketch. Included is 2 coats (total 16 mils) coal tar epoxy lining and one finish coat of enamel outside.

weight 1900# Price $ 3690.00

F.O.B.: our shop, North Vancouver
Federal Sales Tax: not included
Provincial Sales Tax: not included
Terms: net 30 days
Delivery: 3-4 weeks

We thank you for this opportunity to quote and if we can be of any further assistance, please call.

Yours truly,

Martin Jergens
Estimator,
W.A. Thom (1983) Ltd.

Mj/bb

TERMS AND CONDITIONS

1. ACCEPTANCE
This quotation is subject to acceptance within 30 days from the date hereof unless otherwise specified herein, and, until accepted, is subject to change upon notice. The order for items quoted may be placed and acknowledged by you only on the terms and conditions set forth on the face and reverse side hereof and without modification, addition, deletion oralteration, and shall constitute a contract on such terms andconditions either when signed and delivered by you to us or otherwise acknowledged by you, and accepted in writing by us, or when you or your agent has accepted delivery of the whole or any part of the items herein described.

2. ADJUSTMENT OF PRICE:
This quotation is based on present costs of labour and materials and services, duties, freight, taxes and exchange, where applicable and if by reason of any increase or decreasetherein before the completion of the work, the actualcost to us shall be increased or decreased, the contract price shall be adjusted accordingly.

3. PRICE:
Unless otherwise specified herein:
(a) prices quoted are f. o. b. Shipping Branch unless otherwise specified herein;
(b) all prices quoted are exclusive of Federal and Provincial sales taxes, and any other taxes which may be applicable unless otherwise specified herein, and
(c) crating, packing, loading and securing to conveyor expenses are not included in prices quoted.

4. TERMS:
Unless otherwise specified herein, all invoices are due and payable 30 days following the date of the invoice.

5. LOSS OR DAMAGE IN TRANSIT:
Unless otherwise specified herein, the risk of loss or damage to the items quoted shall pass to you upon delivery by us to the carrier.

6. WARRANTY:
Within the limits of this clause, the items quoted herein are warranted to be free of defects in material and workmanship, and if any item, or part thereof, should show defective material or workmanship within 60 days from the date of shipment, we agree to repair or replace same at our cost in our shipping branch upon receipt of sufficient evidence of the defect claimed. We do not warrant to any extent whatsoever any item, or part thereof, not manufactured by us or any work not performed by us or any material supplied to us. Any such item, part thereof, work or material shall carry only such third party warranties, if any, which may apply for your benefit.

7. EXCUSES FOR NON PERFORMANCE:
We shall not be liable for delay or cancellation due to causes beyond our control, including but not limited to, strikes, lock-outs, labour disputes, fires, acts of God and inability to obtain necessary labour, materials or manufacturing facilities.

8. LIABILITY:
Except as hereunder provided, we shall not be under any liability to you in contract, tort or otherwise, and any liability expressly provided elsewhere hereunder shall be subject to the following limitations and exceptions, namely:
(a) in no circumstance whatsoever, shall we be liable, nor shall any claim be made against us for indirect or consequential damage, including without limitation, loss of profits or damages or damages consequential upon loss of use, and
(b) subject to paragraph 6 hereof, all liability of every kind on our part shall cease upon delivery by us of the items quoted.

9. ASSIGNABILITY:
Neither the contract constituted hereunder, nor any claim against us arising thereunder shall be assignable by you without our prior written consent.

10. CONTRACT SUPERSEDES:
The contract constituted hereunder shall supersede all prior agreements, correspondence and undertakings or commitments, whether oral or written, made between us.

11. PATENTS:
You shall indemnify and save us harmless from and against any liability, royalties, costs or expenses of any kind or nature whatsoever arising out of or by reason of the infringement or claimed infringement of any right of invention, patent, trade mark or process of manufacture involved in the manufacture or use of any design or product not designed by us and described in your specifications or enquiry.

12. GENERAL PROVISIONS:
(a) After commencement of manufacture, orders are not subject to cancellation or change without the prior written consent of us. Accepted orders will be subject to our prevailing delivery schedule at time of receipt of order unless otherwise arranged. Once delivery is arranged, you may change delivery, providing five or more calendar days notice is given.
(b) If you shall fail to pay any accounts when due under this contract, or to pay at maturity any note or notes given in respect thereof, we may at our option suspend deliveries of this contact until such time as this default shall have been cured.
(c) If your financial position becomes impaired in our judgement or is unsatisfactory to us or if any account small remain unpaid at due date, we may defer subsequent deliveries and may demand that cash payment or satisfactory security be furnished forthwith as a condition precedent to the resumption of deliveries, in such case, should you after demand, fail to pay cash or to furnish satisfactory security or fail to take care of overdue accounts, such failure will release us from our obligations to make any further deliveries hereunder and all obligations to you hereunder shall become due forthwith and must be paid immediately upon the demand of us or our agent. If, however, such default shall continue for a period of thirty (30) days after we or our agent shall have given written notice to you stipulating such default, then this contract may at our option be cancelled following expiration of such notice, provided you shall remain liable for all of your obligations hereunder incurred up to the date of such termination.
(d) All stock or merchandise owned by you and held for or received from you will be stored by us only at your risk and expense subject to exercise of reasonable care by us.
(e) The contract constituted hereunder shall be governed in all respects by the law of the Province of British Columbia, Canada.

SCHEDULE I - SCHEDULE OF PRICES

COOLING TOWER SUMP

1.	Cooling tower sump as described in the specification, FOB point of sale		$ 3695.00 *
2.	Canadian Customs Duty _____ % of $ __________		$ —
3.	Transportation to site		$ 1000.00 **
		TOTAL	$ 4695.00 *

* FEDERAL OR PROVINCIAL TAX NOT INCLUDED.

** ESTIMATE only.

SCHEDULE II - TECHNICAL DATA

COOLING TOWER SUMP

1.0 SPECIFICATIONS

Manufacturer's name W.A. THOM. (1983) LTD.

Vendors name SAME.

Tank shell material 3/16" (4.8 mm) CARBON STEEL. A.36

Shell thickness 4.8 mm *

Type of coating COAL TAR EPOXY - 2 COATS

Thickness of coating .5 mm

Anchor bolt diameter 20 mm

Total weight 868 kg

2.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3-4 weeks

* Bottom plate = 6 mm

161-1

161-1
BAGHOUSE

BIDDER'S LIST

BAGHOUSE (161-1)

Aerex Corporation
Lot 43, RR3
Scotstown, Quebec
JOB 3B0

Beckland Equipment Ltd.
3118 Beta Avenue
Burnaby, B.C.
V5G 4K4

Attn: Mr. Wm. S. Massey

F. Drexel Western Ltd.
4084 McConnell Court
Burnaby, B.C.
V5A 3N7

Attn: Mr. Ray Mathieson

Ducon-Mikropul Ltd.
1940 Steeles Ave. East
Bramalea, Ontario
L6T 1A7

P.J. Hannah Ltd.
5350 Imperial St.
Burnaby, B.C.
V5J 1E6

Attn: Mr. John Balderson

Joy Manufacturing Co.
235 King St., East
Kitchener, Ontario
N2G 4N6

McCarthy & Robinson Inc.
321 Progress Avenue
Scarborough, Ontario
M1P 2Z7

Attn: Mr. Howard Bushnell

(BROCHURE INCL.) 161-1

DUCON-MIKROPUL LIMITED

1940 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

December 5, 1983.

integ
DEC 12 1983
GRC
FILE

Integ Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

Attention: Mr. G.R. Cooper,
Project Manager

Gentlemen:

Subject: Your File: 0423-EL
Energy Mines & Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Fabric Filter Dust Collector
Ducon-Mikropul Proposal: S-5883

In response to your inquiry dated October 21, 1983, regarding the supply of one Fabric Filter Dust Collector, we are pleased to enclose our proposal S-5883 for your consideration.

Please refer to our marked-up drawing D-23983 for general arrangement and dimensions.

We have sloped the dust collector hopper cone to 45° in order to fit into the available headroom.

Baghouse is supplied with "Nomex" filter bags which are suitable for 400°F continuous operating temperature. However, the bags would permit a short period surge of 436°F temperature.

We trust you will find our proposal to your entire satisfaction. Should you have any questions, please do not hesitate to call the under-signed.

Yours very truly,
DUCON-MIKROPUL LIMITED.

Swapan Mitra
Engineering Sales.

Enclosures.

/jv

EQUIPMENT SPECIFICATION

One (1) only Ducon-Mikropul Mikropulsaire Dust Collector Model: 64S-4-20 sized to handle 1249 CFM (.59 Am^3/sec.) of air @ 4.14:1 air-to-cloth ratio, complete with the following:-

- 12 ga. carbon steel construction all welded housing.
- Tubesheet assembly.
- Hopper section.
- Compressed air header assembly complete with solenoids.
- Cast aluminum twist lock venturis.
- 4'-0" long Nomex bags complete with copper grounding strips. Qty: 64.
- H.R.S. bag retainers.
- Stainless steel bag clamps.
- Housing access door.
- Support structure.
- Access ladder.
- Service platform.
- Insulation.
- U-tube manometer.
- Solid state timer in CEMA 9 enclosure.
- Unit shipped assembled. Bags, retainers, and support structure shipped loose.
- All electrics will be explosion proof.

SCHEDULE I - SCHEDULE OF PRICES

DUST COLLECTOR

1.	One (1) dust collector as described in the specification, FOB point of sale	$ 8,990.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ -
3.	Transportation to site	$ 300.00 (Estimated)
	TOTAL	$ 9,290.00

The following items are not included:-

- Installation.
- Electrical wiring.
- All ductwork.
- Compressed air supply for dust collector.

Our price is based on:-

F.O.B.:	Point of manufacture.
All Taxes:	Extra.
Delivery:	Six (6) to eight (8) weeks after approval.
Terms:	Net thirty (30) days.
Validity:	To January 4, 1984.

DUCON-MIKROPUL LIMITED

SCHEDULE II - TECHNICAL DATA
DUST COLLECTOR

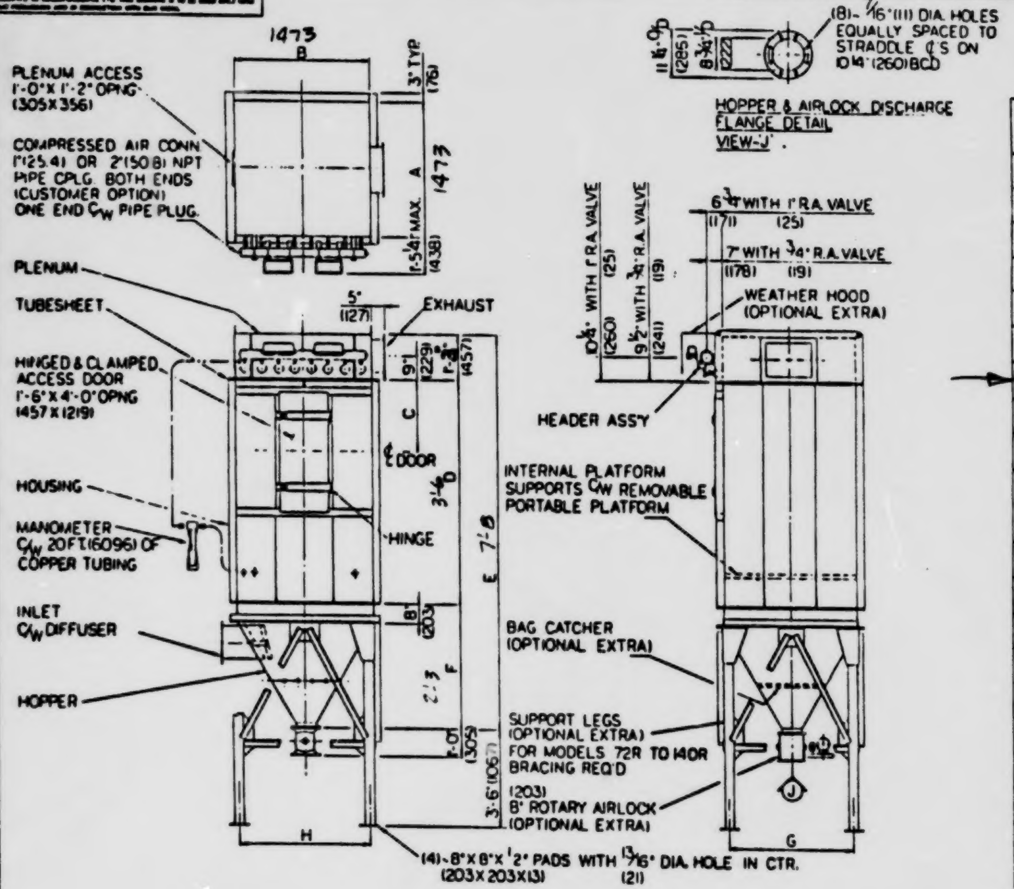
1.0 SPECIFICATIONS

Manufacturer's Name	DUCON-MIKROPUL LIMITED.	
Vendor's Name	DUCON-MIKROPUL LIMITED.	
Model and Type	MIKROPULSAIRE 64S-10-20	
Baghouse Dimensions	PER DRAWING	mm
Unit Total Weight	728	kg
Inlet Flange Size	AS REQUIRED	mm
Outlet Flange Size	AS REQUIRED.	mm
Hopper Flange Size	PER DRAWING	mm
Compressed Air Connection Size	PER DRAWING	mm
Filter Access (Side/Top)	SIDE	
Insulation Thickness	76.2	mm
Filter Material	NOMEX	
Filter Material Temp. Limit	215	°C
Bag Dimensions	108 dia. x 1219 LONG	mm
Filter Area	27.98	m^2
Air: Cloth Ratio	4.14:1	
Compressed Air Requirement	PER DRAWING	m^3/s
Control power requirements	______ VA 115 V 1	phase
Electrical Requirement	-	kW
Maximum Design Pressure	.097	kPa
Actual Pressure Drop	.019	kPa

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

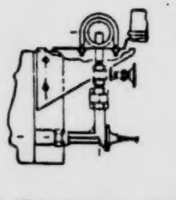
Time required for manufacture and
shipment from receipt of order 1½ to 2 months
(After Approval)


1473
B
PLENUM ACCESS
1'-0"X 1'-2" OPNG
(305X356)
COMPRESSED AIR CONN
1"(25.4) OR 2"(50.8) NPT
PIPE CPLG. BOTH ENDS
(CUSTOMER OPTION)
ONE END C/W PIPE PLUG.
3" TYP
(76)
A
1473
1'-5¼" MAX.
(438)
PLENUM
TUBESHEET
5"
(127)
EXHAUST
9"
(229)
1'-6"
(457)
HINGED & CLAMPED ACCESS DOOR
1'-6" X 4'-0" OPNG
(457 X 1219)
C
℄ DOOR
3'-6"
D
HOUSING
MANOMETER
C/W 20FT.(6096) OF
COPPER TUBING
HINGE
E 7'-8"
8"
(203)
INLET
C/W DIFFUSER
2'-3"
F
HOPPER
1'-0"
(305)
3'-6"(1067)
H
(4)-8"X 8"X ½" PADS WITH 13/16" DIA. HOLE IN CTR.
(203X 203X13) (21)
(8)- 7/16"(11) DIA. HOLES
EQUALLY SPACED TO
STRADDLE ℄'S ON
10¼"(260) BCD
11¼"
(285)
8¾"
(222)
HOPPER & AIRLOCK DISCHARGE
FLANGE DETAIL
VIEW-'J'.
10¼" WITH 1" R.A. VALVE
(260) (25)
9½" WITH ¾" R.A. VALVE
(241) (19)
6¾" WITH 1" R.A. VALVE
(171) (25)
7" WITH ¾" R.A. VALVE
(178) (19)
WEATHER HOOD
(OPTIONAL EXTRA)
HEADER ASSY
INTERNAL PLATFORM
SUPPORTS C/W REMOVABLE
PORTABLE PLATFORM
BAG CATCHER
(OPTIONAL EXTRA)
SUPPORT LEGS
(OPTIONAL EXTRA)
FOR MODELS 72R TO 140R
BRACING REQ'D
(203)
8" ROTARY AIRLOCK
(OPTIONAL EXTRA)
J
G

MODEL	A FT.& IN. mm	B FT.& IN. mm	C FT.& IN. mm	D FT.& IN. mm	E FT.& IN. mm	F FT.& IN. mm	G FT.& IN. mm	H FT.& IN. mm	Nº OF RIGHT ANGLE VALVES	SIZE OF RIGHT/ IN ANGLE VALVE/ mm	FILTER AREA SQ FT (m²)	COMPRESSED AIR REQ'D SCFM@100psi (m³/min @690 kPa)	UNIT WEIGHT LBS (kg) APPROX
42R-8-20	4'-3" (1295)	3'-8" (1118)	2'-6" (762)	7'-9" (2362)	13'-1" (3988)	3'-10" (1168)	3'-11" (1194)	3'-4" (1016)	6	¾" (19)	395 (36.7)	3.6 (6.1)	1775 (805)
42R-10-20			2'-6" (762)	9'-9" (2972)	15'-1" (4597)						494 (45.9)		2100 (953)
49S-8-20	4'-3" (1295)	4'-3" (1295)	2'-6" (762)	7'-9" (2362)	13'-1" (3988)	3'-10" (1168)	3'-11" (1194)	3'-11" (1194)	7	¾" (19)	461 (42.8)	4.2 (7.1)	1900 (862)
49S-10-20			2'-6" (762)	9'-9" (2972)	15'-1" (4597)						577 (53.6)		2200 (998)
56R-8-20	4'-10" (1473)	4'-3" (1295)	2'-6" (762)	7'-9" (2362)	13'-7" (4140)	4'-4" (1321)	4'-6" (1372)	3'-11" (1194)	7	¾" (19)	527 (49.0)	4.2 (7.1)	2100 (953)
56R-10-20			2'-6" (762)	9'-9" (2972)	15'-7" (4750)						659 (61.2)		2425 (1100)
64S-4-20	4'-10" (1473)	4'-10" (1473)	2'-6" (762)	3'-6"	7'-8"	2'-3"	4'-6" (1372)	4'-6" (1372)	8	¾" (19)	603 (56.0)	4.8 (8.2)	2250 (1021)
64S-10-20			2'-6" (762)	9'-9" (2972)	15'-7" (4750)						753 (69.9)		2600 (1179)
72R-8-20	5'-5" (1651)	4'-10" (1473)	2'-6" (762)	7'-9" (2362)	14'-1" (4293)	4'-10" (1473)	5'-1" (1549)	4'-6" (1372)	8	¾" (19)	678 (63.0)	4.8 (8.2)	2500 (1134)
72R-10-20			2'-6" (762)	9'-9" (2972)	16'-1" (4902)					1" (25)	849 (78.9)	6.7 (11.4)	2875 (1304)
81S-8-20	5'-5" (1651)	5'-5" (1651)	2'-6" (762)	7'-9" (2362)	14'-1" (4293)	4'-10" (1473)	5'-1" (1549)	5'-1" (1549)	9	¾" (19)	763 (70.9)	5.4 (9.2)	2700 (1225)
81S-10-20			2'-6" (762)	9'-9" (2972)	16'-1" (4902)					1" (25)	954 (89.6)	7.6 (12.9)	3100 (1406)
90R-8-20	6'-0" (1829)	5'-5" (1651)	2'-6" (762)	7'-9" (2362)	14'-7" (4445)	5'-4" (1626)	5'-8" (1727)	5'-1" (1549)	9	¾" (19)	849 (78.9)	5.4 (9.2)	2925 (1327)
90R-10-20			2'-6" (762)	9'-9" (2972)	16'-7" (5055)					1" (25)	1060 (99.5)	7.6 (12.9)	3375 (1531)
100S-8-20	6'-0" (1829)	6'-0" (1829)	2'-6" (762)	7'-9" (2362)	14'-7" (4445)	5'-4" (1626)	5'-8" (1727)	5'-8" (1727)	10	¾" (19)	942 (87.5)	6.0 (10.2)	3100 (1406)
100S-10-20			2'-6" (762)	9'-9" (2972)	16'-7" (5055)					1" (25)	1178 (109.4)	8.4 (14.3)	3350 (1520)
110R-8-20	6'-0" (1829)	6'-7" (2007)	2'-6" (762)	7'-9" (2362)	15'-1" (4597)	5'-10" (1778)	5'-8" (1727)	6'-3" (1905)	11	¾" (19)	1037 (96.3)	6.6 (11.2)	3350 (1520)
110R-10-20	6'-7" (2007)	6'-0" (1829)	2'-6" (762)	9'-9" (2972)	17'-1" (5207)				10	1" (25)	1296 (120.4)	8.4 (14.3)	3850 (1746)
120R-8-20	6'-0" (1829)	7'-2" (2184)	2'-6" (762)	7'-9" (2362)	15'-7" (4750)	6'-4" (1930)	5'-8" (1727)	6'-10" (2083)	12	¾" (19)	1131 (105.1)	7.2 (12.2)	3550 (1610)
120R-10-20	7'-2" (2184)	6'-0" (1829)	2'-6" (762)	9'-9" (2972)	17'-7" (5359)				10	1" (25)	1414 (131.3)	8.4 (14.3)	4050 (1837)
130R-8-20	7'-9" (2362)	6'-0" (1829)	2'-6" (762)	7'-9" (2362)	16'-1" (4902)	6'-10" (2083)	5'-8" (1727)	7'-5" (2261)	10	1" (25)	1225 (113.8)	9.0 (15.3)	3900 (1774)
130R-10-20			2'-6" (762)	9'-9" (2972)	18'-1" (5512)						1532 (142.3)	12.0 (20.4)	4350 (1973)
140R-8-20	8'-4" (2540)	6'-0" (1829)	2'-6" (762)	7'-9" (2362)	16'-7" (5055)	7'-4" (2235)	5'-8" (1727)	8'-0" (2438)	10	1" (25)	1319 (122.6)	9.0 (15.3)	4000 (1814)
140R-10-20			2'-6" (762)	9'-9" (2972)	18'-7" (5664)						1649 (153.2)	12.0 (20.4)	4550 (2064)

NOTES -

1. ELECTRICAL: TOTALLY ENCLOSED CEMA 12 (OPTIONAL)-CEMA 4.
   EXPLOSION PROOF CEMA 7 OR 9 (OPTIONAL)
2. POWER REQUIREMENTS: SOLENOIDS. 110-1-60
   TIMER 110-1-60
   AIRLOCK. 575-3-60
3. TIMER, MANOMETER, BAGS & RETAINERS SHIPPED LOOSE FOR INSTALLATION BY OTHERS.
4. COMPRESSED AIR SUPPLY TO BE CLEAN AND FREE OF OIL AND WATER AT ALL TIMES.
5. PAINT: ONE COAT OF GREEN PRIMER 1231 EXTERIOR AND INTERIOR.
   OPTIONAL EXTRA-FINISH COAT EXTERIOR ONLY GREEN HAMMERTONE FINISH E-983.



HEADER ASSY SHOWING OPTIONAL GATE VALVE

	ROD	SEPT. 1982
	Z.Z.	APR. 1983
	NTS	

DUCON-MIKROPUL LTD.

— ARRANGEMENT OF
STD. DUST COLLECTOR
MODELS 42R TO 140R

D-23983

CONDITIONS OF SALE AND WARRANTY

GENERAL:

A) All purchase orders are subject to acceptance by the home office of Ducon-Mikropul Ltd. as evidenced by a signed acknowledgement which will be forwarded to the purchaser.

B) The contract is entered into at the factory of the seller in Bramalea where the order based hereon is accepted. The entering into, construction, interpretation, performance and discharge of this contract will be governed by the laws of Ontario.

C) In case performance hereunder by the Company shall be delayed or rendered impossible by force majeure, including war, governmental authority, embargoes, prohibition of or restriction on exports or imports, civil commotions, labor difficulties, accidents, loss or damage by act of God or the elements, intereferences with transportation, closing or interruption of customary short routes of transportation or any other contingency beyond the Company's control and whether herein specifically enumerated or not in the connection with the production or transportation of the equipment which is the subject of this order expected arrival shall be extended for a period equal to the duration of the contingency and for a sufficient time thereafter in which to make shipment. The Company shall in no event be held responsible for any contingency beyond its control whether herein specifically provided for or not.

PAYMENT AND SALES TAX:

A) Prices to not include any present or future local, provincial or federal excise, sale privilege or uses taxes. The amount of such taxes will be added to the sales price if the Company is required to pay them.

B) Title to the equipment shall pass to the purchaser upon delivery to the carrier.

C) Prorata payments will become due as shipment is made. If shipments are delayed by the purchaser, payment shall become due on the date the Company is prepared to make shipment. Equipment held for the purchaser shall be at the risk and expense of the purchaser.

D) In the event the purchaser defaults on any payment, or in the event the financial responsibility of the purchaser becomes impaired or unsatisfactory to the Company, the full amount of all payments required hereunder which are unpaid shall, at the election of the Company, become immediately due and payable. Upon default of the purchaser in complying with the terms of the payment hereof, the Company may take immediate possession of any equipment delivered to the purchaser pursuant to the within purchase order without legal process, without demand and for this purpose the Company may enter any premises where said equipment may be found and remove same.

CANCELLATION :

Cancellation of orders accepted by the Company can be made only with the Company's consent. The purchaser shall pay the full purchase price for all items completed. On such items that are not completed, a charge will be made for materials used and labor costs together with sales engineering and administrative overhead plus profit as per the original purchase order. A minimum charge of 10% of purchase price for cancellation will apply.

WARRANTY:

A) Materials:

The Company warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in material and workmanship under normal use and service for twelve (12) months after shipment (except filter tubes - ninety (90) days). This warranty does not cover products, accessories, parts of attachments which are not manufactured by the Company and shall receive only such warranty, if any, as given by the manufacturer thereof. Warranty does not apply where undue wear or breakage is caused by careless or improper handling or where defects are remedied by others or when operating instructions are not adhered to. The Company shall have the option to require the return of any alleged defective part, transportation prepaid, to establish the claim. If the Company's examination shall disclose such parts to have been so defective, the Company will repair or replace said part for the purchaser, f.o.b. Company's plant. The Company's liability in this warranty is limited to the above and in no case can exceed the purchase price of the equipment involved. In no event shall the Company be liable for any consequential damages, secondary charges, expenses or such resulting from any alleged defect.

Any repairs or substitutions made by the purchaser without the written consent of the Company will void all warranties. The Company will not allow charges made by the purchaser for repairs and alterations without written consent or approval from the Company.

IT IS UNDERSTOOD THAT THE COMPANY ASSUMES NO RESPONSIBILITY FOR THE SELECTION OF CONSTRUCTION MATERIALS FOR RESISTANCE TO AND THE EFFECTS OF CORROSION AND/OR EROSION.

B) Performance:

No warranty, either oral, written or implied as to performance of equipment supplied is extended unless specifically stated on the face of the acknowledgement.

SHIPMENT:

A) Special loading, crating or boxing specified by the purchaser will be charged at an additional cost.

B) The Company assumes no responsibility for loss or damage incurred in transit. Claims for such loss or damage should be filed by the purchaser with the carrier.

C) Shipments are normally made charges collect and routed as per the purchaser's instructions unless approval is obtained from purchaser for rerouting to best suit commodity covered. If not specified shipment will be made via "Best Way" at the Company's convenience. The Company reserves the right to make partial shipments and cannot guarantee the extent of assembly of component parts which will vary depending upon the method of shipment used unless specifically covered on the face of this acknowledgement.

INSTALLATION:

The equipment furnished by the Company will be installed by and at the expense of the purchaser. Competent field supervision can be supplied by the Company on a per diem rate plus living and traveling expenses.

FOUNDATIONS AND AUXILIARIES:

In no case will the Company design and detail foundation or provide foundation bolts. Unless otherwise specified, structural supports, stairways, access ladders, platforms, insulation and attachment, connecting duct work, bolts and gaskets for attaching thereto are not included.

SAFETY DEVICES:

No special safety devices are included unless specified to the contrary.

PATENTS:

The Company agrees to defend any suits brought against purchaser for alleged infringement due to construction or design of Company's machinery provided we are immediately informed in writing on receipt of said charges and provided we are given complete control of the defense and also that we have the right to defend or settle the carge or to make necessary changes in the equipment to avoid infringement. We do not agree to defend infringement suits involving accessories not of Company's manufacture or suits based on use of equipment in combination with other equipment or suits involving process patents.

STANDARD SHOP PRACTICE:

All equipment will be cleaned of dirt, loose scale, and spatter. Carbon steel materials will be given one coat of primer unless additional painting is specified in purchaser's order in which case we will advise you of additional charges if applicable

The Company reserves the right to make minor changes or improvements in design and construction.

The Company welcomes purchaser's inspection of materials and workmanship of our equipment in the shop provided such inspection and acceptance does not result in undue delay. If special tests, inspection procedures or pre-assembly resulting in additional expense or delay are specified by the purchaser, the Company will promptly advise the extra charge involved which will be added to the purchase price.

(BROCHURE INCL)   161-1

JOY
JOY MANUFACTURING COMPANY (CANADA) LIMITED
PRECIPITATION DIVISION
235 KING ST. E., KITCHENER, ONT. N2G 4N6 · (519) 578-6400 · TELEX: 069-55324
970 MONTÉE DE LIESSE, SUITE 306, MONTREAL, QUE. H4T 1W7 · (514) 337-2215 · TELEX: xxxxxxx 05-824850

November 30, 1983   Kitchener Office

integ
DEC-2 1983
CIRC   DATE

Intercontinental Engineering Limited
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: G. R. Cooper
Project Manager

Subject: Pulseflo Bag Filter Dust Collector
Your Reference File 0243-E1
for Canmet Energy Research Lab.
Our Proposal: K8403-702

Gentlemen:

Further to your inquiry of October 21, 1983, we are pleased to offer this proposal for one (1) JOY Pulseflo dust collector, PF^{2}6004-56 to meet your requirement for clean up of fluidized bed combustor flue gas.

This is all in accordance with the attached data sheets, Drawing MO-46077-B and General Terms and Conditions Form 81-A which all make up part of this proposal.

We thank you for this opportunity to bid on your requirements and trust you find this proposal satisfactory. Should you have any further questions, please contact this office or P.J. Hannah Equipment Sales Corporation in Burnaby.

Yours very truly,

JOY Manufacturing Company (Canada) Limited
PRECIPITATION DIVISION

H. Flatt

H. Flatt
Inside Sales Department

CC: John Balderston - PJHannah - Burnaby
Attach. as indicated above

ELECTROSTATIC PRECIPITATORS • FGD SYSTEMS • FABRIC FILTERS • WET SCRUBBERS • CYCLONIC COLLECTORS

JOY

JOY MANUFACTURING COMPANY (CANADA) LIMITED
PRECIPITATION DIVISION

QUOTATION SUMMARY

Customer Ref: Canmet Energy Research Lab Our Ref: K8403-702

Integ File 0243-E1

1.	Equipment Price: 1 - PF^2 6004-56 Pulseflo Bag Filter c/w Manual Slide Gates Airlocks not included.	$ 10,050.00
2.	Duty Brokerage and other charges	$ N/A
	(if applicable itemized)	$ N/A
3.	Federal Sales Tax @ % If Applicable	$ Extra
4.	Provincial Sales Tax @ % If Applicable	$ Extra
5. *	Sub-Total F.O.B. Shops (See Note Below)	$ 10,050.00
6.	Estimated Freight (to be invoiced at cost)	$ 250.00
7.	Total Value F.O.B Ottawa	$ 10,300.00

8. Terms of payment Net 30 Days

9. Submit data for review 2-3 weeks after receipt of Purchase Order

10. Deliver equipment 8-10 weeks from receipt of reviewed drawings.

11. Shipping Point Shop F.O.B. Point Montreal

12. Carrier (proposed) on which freight charges based Cheapest

13. Total weights: Gross 2,400 lbs. Net 2,200 lbs.
Heaviest Section - Total Shipping Vol. 210 Cu. Ft.

14. Quotation firm and valid for 30 days from quotation date for shipment May 1984 latest.

Date November 30, 1983 by JOY Manufacturing Company (Canada) Ltd.
Kitchener, Ontario

Signature
H. Flatt
Sales Department

*Note: Deduction for Alternate No. 1 (See Description)
i.e. - Single hopper only with single manual slide gate
DEDUCT - $200.00

JOY MANUFACTURING COMPANY (CANADA) LIMITED
PRECIPITATION DIVISION

UNIT DESCRIPTION

One (1) only JOY "Pulseflo" high energy dust filter

- Model PF^{2}6004-56
- Generally as shown on the attached Drawing MO-46077-B.
- This unit will clean 1250 ACFM of fluidized bed combustor flue gas at 350°F.

Construction and Fittings as follows:

56 - 6 inch diameter x 4 feet long, 14 oz. woven fiberglass teflon coated clamp type bags having a filter area of 351 square feet giving an air to cloth ratio of 3.55:1. Each bag is grounded and is supported by an electro galvanized plated mild steel bag cage.

8 - 1 inch JOY integrated right angle diaphragm air valves complete with solenoid assemblies mounted on one external header. From the external header via the air valves there are eight (8) distribution pipes with holes on the underside centred above each bag to produce a pulse shock wave for bag cleaning action.

1 - Solid state timer Nema 4 enclosure, 115/1/60 supply
- pulse timer is 50 - 500 Milliseconds
- dwell time is 2-24 seconds

1 - Magnehelic gauge

Unit of all welded construction suitable for ± 25 in. W.G. 12 gauge mild steel housing and pyramid type hoppers (two) with 4 inch diamter flanged discharges.

3/16 inch mild steel tube sheet.

Manual slide gates supplied at each hopper discharge.

Gasketted and hinged access door in housing for bag inspection and removal.

One flanged gas inlet in hopper and flanged outlet in plenum.

Diffusion baffle plate at gas inlet.

Inspection hole in each hopper.

Bottom of support legs flush with bottom of hopper discharge flanges.

Housing and hopper to be covered with 4 inch fiberglas insulation and 24 gauge steel cladding.

Manufacturer's standard primer paint external surfaces only.

Pressure drop at normal operating conditions is 4 - 6 inches W.G.

Compressed air requirements: 11.2 SCFM @ 75 PSIG, clean and dry based upon complete cleaning cycle in one minute.

........2/

Airlock(s) not included. To be supplied by others.

Alternative No. 1

Supply unit with one hopper only. Thus only one manual slide gate would be included. Hopper length would increase to 3'8" in order to have a suitable hopper valley angle of 48°.

Overall height of unit would increase to 8'6".

Note: Only one airlock is required (to be supplied by others).

SCHEDULE I - SCHEDULE OF PRICES

DUST COLLECTOR

*	1.	One (1) dust collector as described in the specification, FOB point of sale	$ 10,050
	2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ N/A
	3.	Transportation to site	$ 250
		TOTAL	$ 10,300

* Deduction for Alternate 1 (See Description)

i.e. Single hopper only with single manual slide gate

DEDUCT: $200.00

SCHEDULE II - TECHNICAL DATA
DUST COLLECTOR

1.0 SPECIFICATIONS

Manufacturer's Name	JOY Manufacturing Company (Canada) Ltd. PRECIPITATION DIVISION	
Vendor's Name	JOY Manufacturing Company (Canada) Ltd. PRECIPITATION DIVISION	
Model and Type	PULSEFLO PF^{2}6004-56	
Baghouse Dimensions	1676 x 1473 x 2388	mm
Unit Total Weight	1000	kg
Inlet Flange Size	200	mm Dia.
Outlet Flange Size	150 x 300	mm
Hopper Flange Size	100	mm Dia.
Compressed Air Connection Size	63.5	mm
Filter Access (Side/Top)	Side	
Insulation Thickness	100	mm
Filter Material	Woven Fiberglas Teflon Coated	
Filter Material Temp. Limit	+ 260	°C
Bag Dimensions	150 Dia.x 1219	mm long
Filter Area	9.96	m^2
Air: Cloth Ratio	3.6: 1	
Compressed Air Requirement	.005	m^3/s
Control power requirements	100 VA 120 V 1	phase
Electrical Requirement	N/A	kW
Maximum Design Pressure	± 6.2	kPa
Actual Pressure Drop	1 - 1.5	kPa

2.0 LIST OF ALTERNATIVES AND EXTRAS

ALTERNATIVE 1

Supply single hopper which would increase total height of unit from 2388 mm to 2591 mm. (see quotation summary for price deduction)

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order three (3) months

PRECIPITATION DIVISION

JOY MANUFACTURING COMPANY (CANADA) LIMITED

11.0 GENERAL TERMS AND CONDITIONS

11.1 GUARANTEES

Material and Workmanship Warranty

The Company will replace or repair without charge FOB original point of shipment, parts found to be defective in material or workmanship under normal and proper use (wear and tear from abrasion and/or corrosion excepted) within twelve (12) months of the date the installation commences to operate but no later than eighteen (18) months from the date the equipment is ready for shipment. The Purchaser shall give the Company prompt written notice of such defects.

The responsibility of the Company under this guarantee is limited to the cost of the defective parts and shall not include any disassembly and/or re-installation costs. The Purchaser shall give all reasonable assistance free of charge to any corrective efforts by the Company.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, STATUTORY OR IMPLIED, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

11.2 RESPONSIBILITY

Title to the material and equipment hereunder shall pass to the Purchaser upon delivery to the carrier at point of shipment except when the Company is also erecting the material or equipment in which case title shall pass to the Purchaser upon completion of erection. The Purchaser thereafter shall assume full responsibility for any loss of or damage to such material or equipment except for damage resulting from negligence f the Company.

The Company shall not be responsible for any delay in performance or for any failure to perform caused by acts of God, fires, strikes, labour or material shortages, failure of material procurers, vendors, fabricators and equipment suppliers to deliver on schedule or any other cause over which the Company has no control.

In no event shall the Company incur liability for:

a) Indirect, incidental, consequential or special damages of any character, including, but not limited to, loss of profits and revenues resulting from plant shut-down or non-operation of equipment, lost production, increased expense of operation, property damage, damages suffered by Purchaser or others from loss of use of productive facilities and loss or harm to third parties.

b) Defects in equipment procured hereby caused by corrosion or abrasion.

c) Loss or harm caused by sole negligence of Purchaser.

d) Loss of or damage to equipment furnished by the Company after transfer of care, custody or control of that equipment from the Company.

e) Compliance with air pollution laws, statutes, regulations and ordinances.

Notwithstanding any provisions of this contract, express or implied, the Company shall have:

a) An equitable adjustment in the contract price for delays caused by Purchaser.

b) A reasonable extension in periods of performance when the Company is delayed by cause over which the Company has no reasonable control.

c) Full compensation for all costs incurred and a reasonable allowance for profit if this contract is cancelled.

d) The Company's sole responsibility and the Purchaser's sole and exclusive remedy (for breach of any covenant, warranty or guarantee contained herein including, but not limited to, a breach of any of the provisions of the performance guarantee hereof or a fundamental breach hereof or for any negligence whatsoever on the part of any person for whose acts it is in law responsible) will be limited at the Company's sole option to repair, replacement or a cash settlement equal to the value of the defective part or parts.

This shall be limited to the original purchase price of the equipment.

11.3 INSURANCE

a) The Company shall maintain for its employees such Workmen's Compensation Insurance and/or Employer's Liability Insurance as is required by law.

b) The Company shall carry Comprehensive Public Liability and Property Damage insurance for the following limits of liability:

Bodily Injury	$ 500,000 per person $1,000,000 per occurrence
Property Damage	$ 500,000 per occurrence $ 500,000 aggregate

11.4 PATENT INDEMNIFICATION

The Company agrees that it will indemnify the Purchaser for all damages or costs resulting from any suit or damage alleging infringement of any Canadian patent claims regarding the structure of the apparatus or any part thereof furnished by the Company under this proposal, if the Company is notified promptly in writing of such suit or demand, either by procuring for the Purchaser the right to continue using the apparatus or part thereof furnished by the company or by replacing same with non-infringing apparatus, or by modifying same so that it becomes non-infringing, or by removing the alleged infringing apparatus and refunding the reasonable portion of the purchase price attributable thereto. On any apparatus or part thereof made to the Purchaser's design or the design of which has been modified by the Purchaser, this indemnification clause does not apply. The Company's sole responsibility and the Purchaser's exclusive remedy for any such suit or demand shall be as set forth in this paragraph.

11.5 DELIVERY SCHEDULE

The Company will make every effort to ship the equipment in accordance with the delivery schedule noted in the introduction of this proposal. The Purchaser, if unable to receive the material shall promptly advise the Company to what point delivery may be made, and shall assume storage charges and additional transportation charges involved and shall assume the risk of all loss or damage while the material is in storage and/or transportation to and from storage.

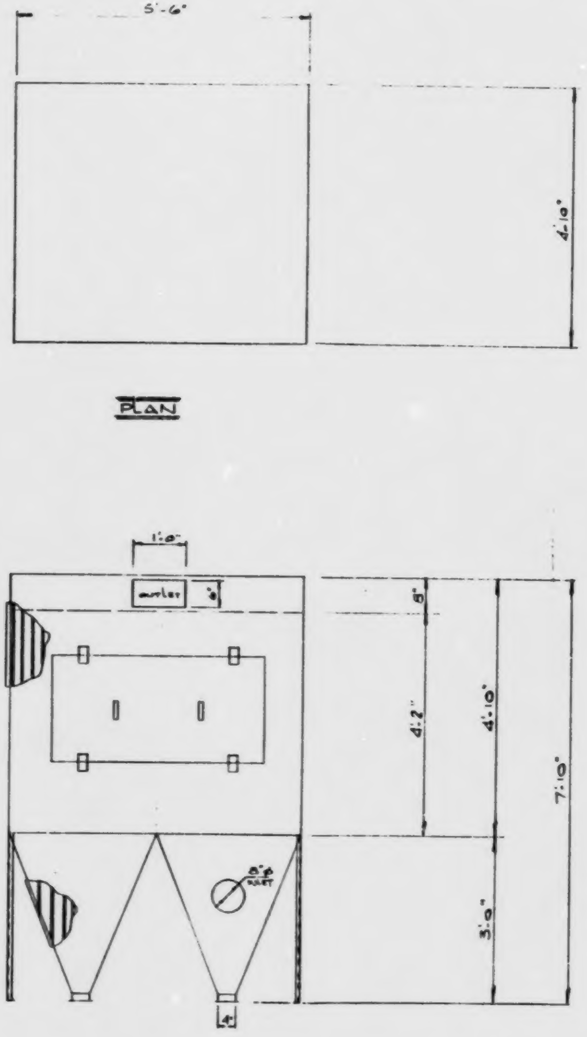
11.6 ACCEPTANCE

The Purchaser agrees to accept the installation and thereby release the Company from all obligations to the Purchaser except those provided under "Material and Workmanship" upon completion of the installation proposed herein.

11.7 EXECUTION

This proposal is valid for acceptance for 60 days unless otherwise stated herein and is subject to revision from the date thereof. There are no agreements nor representations verbal or otherwise, other than as contained in this contract. This proposal shall become a contract between the parties hereto and their successors and assigns when accepted by the Purchaser and executed by an officer of the Company at its home office, Kitchener, Ontario (it being agreed that such contract shall be subject to the laws of the Province of Ontario).

MO-46077-B 0



PRELIMINARY

TOLERANCES — IMPERIAL
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS IN INCHES
ALL FRACTIONAL DIM ± 1/64"
ALL DECIMAL DIM XX = ± .01 XXX = ± .005
ALL ANGULAR DIM — ± 1°
ALL MACHINED SURFACES 250 √
BREAK ALL SHARP EDGES AND CORNERS .015 MAXIMUM

REVISIONS
4
3
2
1
NO MADE CHECKED DATE DESCRIPTION
REFERENCES DWG NO TITLE

DRAWN BY
TRACED BY
CHECKED BY
APPROVED
DATE

PULSEFLO BAGHOUSE
FOR INTEG

JOY MANUFACTURING CO. (CANADA) LTD.
PRECIPITATION DIVISION
KITCHENER, ONT — MONTREAL, QUE.

SCALE ¼" = 1-0"
JOB NO. K8403-702
MO-46077-B 0

PROPOSAL

(BROCHURE INCL.) 161-1

McCARTHY & ROBINSON INC.

INDUSTRIAL SALES • ENGINEERS / VENTES INDUSTRIELLES • INGÉNIEURS

321 PROGRESS AVENUE, SCARBOROUGH, ONTARIO M1P 2Z7 ■ Télex: 065-25117 Tél: (416) 298-1630

QUOTATION NO./COTATION Nº TM83-126

DATE: November 10, 1983

F.S.T./TAXE FÉD. DE VENTE: Extra
P.S.T./TAXE PROV. DE VENTE: Extra
TERMS/MODALITÉS: Net 30 Days-Cdn. Funds
F.O.B./F.À.B.: Factory, Freight allowe to destination
ESTIMATED SHIPMENT/ DATE APPROX. DE L'EXPÉD.: 6 - 8 Weeks

INTEG/INTERCONTINENTAL ENGINEERING LTD.,
1155 West Pender St.
Vancouver.
British Columbia V6E 2P4

Attention: G. R. Cooper, P. Eng.,
Project Manager.

REFERENCE: File 0243-E1 - Sly Dust Control Equipment for Canmet, Ottawa Research Facility:

Gentlemen:

We are pleased to offer a Sly PACTECON to handle flue gas from a fluidized bed combustor as follows:

1 - Sly PACTECON Dust Filter, PC-104, with channel frame base and structural support up to 96" high, complete including --

Factory applied insulation to exterior of case and hopper consisting of 4" fibreglas with 18 Ga. outer lining.

16 Oz. Nomex Cloth MP-99 filter bags, 355 sq. ft. net cloth filtering area for handling 1,250 ACFM at an air-to-cloth ratio of 4.93:1. SHOULD BE 3.5:1 (TYPO)

Heavy gauge sheet steel case with a 6" X 24" dust inlet on either end and one 9-1/2" X 14-1/2" clean air outlet on top.

Standard Hopper and Skirt with 8" hand-operated discharge valve.

Gasketed, quick-release doors in front and back of each section.

Solenoid, cylinders and valves mounted.

Interconnecting compressed air piping at unit.

Electrical enclosure mounted for wiring solenoids.

cont'd.........

ALL QUOTATIONS SUBJECT TO STANDARD TERMS AND CONDITIONS ON REVERSE SIDE
TOUTES LES COTATIONS SONT FAITES SOUS RÉSERVE DES TERMES ET CONDITIONS STANDARD, AU VERSO

Solid-State Timer in NEMA 4 enclosure for 110 volt electrical components mounted on filter case and wired to solenoid valves.

Two (2) coats of paint — the second after final assembly.

Shop assembled, mounted and shipped on channel frame with the filter bags installed. Strustural support and hopper will be shipped loose for attachment in field.

For further details of design, construction and operation, please refer to Bulletin No. 303.

PRICE:..$ 13,354.00

EXHAUST FAN AND ACCESSORIES - PC-104 PACTECON:

1 - No. 174 Industrial Exhaust Fan, Arrangement No. 10, with anti-friction bearings, weather-proof housing, mounting channels, and v-belt drive. Fan to handle 1,700 CFM at 10" static pressure. Fans will be mounted on units where truck size permits.

1 - 7-1/2 H.P., 1800 RPM, T.E.F.C. Motor for 3 phase, 60 cycle, 575 volts.

1 - Fan Pipe and Blast Gate.

1 - Blend Air Damper, Honeywell Modutrole Motor and linkage with temperature thermostat for regulation of blending air to the dust filter.

PRICE:..$ 3,234.00

AIR CLAUSE:

This equipment must be maintained above the dew point at all times and below the maximum allowable temperature of 350°F, for the NOMEX fabric quoted. Therefore, the necessity for the Blend Air Damper to ensure the air entering the dust filter is less than 350°F.

In some elevated temperature processes or high humidity applications, the use of insulation, auxiliary heat, or special operating procedures may be required.

cont'd.........

We would like to thank you for the opportunity to offer our Sly equipment and would be most pleased to work with you on this project.

Yours very truly,

McCARTHY ROBINSON INC.

S. R. Friend,
Toronto District Manager.

SRF/jo

Enclosures: Form 2000
Terms & Conditions
Bulletin No. 303

pc: Vancouver
pc: Montreal
pc: Sly

integ

TELECON REPORT

PROJECT: ARFBC REF 161-1 NO.: ______

INTEG ~~ORIGINATOR OR~~ RECIPIENT: G.R.C.

CALL - FROM/~~TO~~: J. CORCORAN (MATRIX PROJECTS)

DATE: DEC 14 - 1983 TIME: _____ DURATION __________ MIN.

1. __________
2. __________
3. __________
4. __________
5. __________

FILE: 0243-161-1

NAME	INFORMATION	ACTION BY
	RE: MC CARTHY & ROBINSON BAGHOUSE QUOTE. ANSWERS TO QUERIES	
1.	FILTERS ACCESSED FROM FRONT & BACK.	
2.	BLEED AIR INTRODUCED AT 'Y' CONNECTION IN INLET DUCT 10 FT FROM BAGHOUSE. 7½ HP FAN PROVIDED.	
3.	DESIGN BLEED AIR FLOW IS 58 lb/min (773 scfm) AT 79°F TOTAL FLUEGAS BECOMES 2126 ACFM (300F) ~~FROM~~ AGAINST 1250 ACFM AT 350F PREVIOUSLY ADVISED.	

CONFIRMATION IN WRITING: YES/NO

Record COMMITMENTS made - ACTION to be taken - ADVICE or INSTRUCTIONS given - ARRANGEMENTS made - DATES agreed

SCHEDULE I - SCHEDULE OF PRICES

DUST COLLECTOR

1.	One (1) dust collector as described in the specification, FOB point of sale	$ 16,588.00
2.	Canadian Customs Duty (where applicable) 12.1 % of $ 8,666.00 Cdn. Dollars	$ 1,048.61 Included Above
3.	Transportation to site - Included above	$
	TOTAL	$ 16,588.00

SCHEDULE II - TECHNICAL DATA
DUST COLLECTOR

1.0 SPECIFICATIONS

Manufacturer's Name	W. W. Sly Manufacturing Company	
Vendor's Name	McCarthy Robinson Inc.	
Model and Type	PACTECON PC-104	
Baghouse Dimensions	1,333.5 mm Long X 1,638 mm Deep X 1,944	mm High
Unit Total Weight	1,525	kg
Inlet Flange Size	152.4 mm X 609.60	mm
Outlet Flange Size	241.30 X 368.30	mm
Hopper Flange Size	203.20 Sq.	mm
Compressed Air Connection Size	25.4	mm
Filter Access (Side/Top)	Non	
Insulation Thickness	4" (101.6)	mm
Filter Material	Nomex	
Filter Material Temp. Limit	177	°C
Bag Dimensions	914.4mm X 1,117.60	mm
Filter Area	32.98	m^2
Air: Cloth Ratio	4.93:1	
Compressed Air Requirement		m^3/s
Control power requirements	_____ VA _____ V _____	phase
Electrical Requirement		kW
Maximum Design Pressure		kPa
Actual Pressure Drop	1,494.6	kPa

2.0 LIST OF ALTERNATIVES AND EXTRAS

Blend air damper and temperature thermostat for controling inlet air to the filter to ensure that it is below 350°F/117°C

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 2 to 2-1/2 months

TERMS AND CONDITIONS

DESIGNATION OF PARTIES: The term Company whenever used herein refers to The W. W. Sly Manufacturing Company, incorporated under the laws of the State of Ohio and having its principal office in the City of Cleveland, Ohio. The term Purchaser whenever used herein refers to the person, firm or corporation to whom the equipment herein specified is sold.

AGREEMENTS AND REPRESENTATIONS: The proposal hereto attached covers only such material, equipment and services as are specifically mentioned herein, and when executed as herein provided shall constitute the contract between the parties hereto.

No written or verbal agreements or representations heretofore made by any person for or on behalf of the Company or Purchaser shall affect or in any way vary or modify the terms or conditions hereof.

GUARANTEE: The equipment described in the attached proposal is guaranteed only against defective workmanship or material, for a period of one (1) year from date of shipment. In the event defects develop within said period under normal and proper use, the Company will furnish without charge, F.O.B. its plant, parts required to replace material found to have been defective. Under no circumstances will the Company be responsible for the cost of labor to install such parts, or, for loss of production occasioned by failure of such parts. Nothing in the above is to be construed as a guarantee of the service life of parts or equipment not found to be defective.

DRAWINGS:

(1) Certified construction drawings will be forwarded to customer for approval. One copy of drawings properly initialed, or all copies if changes are made, shall be returned to Company within ten days from date issued.

(2) Said drawings not received by Company within ten days may necessitate removal of order from production schedule and thereby may affect date of shipment.

(3) Should any changes be made after approved drawings have been entered for production, normal engineering charges will then be added to customer's order.

(4) Foundation and erecting diagrams, repair part sheets and full operating instructions will be furnished by the Company when required.

TIME OF SHIPMENT: The shipment promise contained in the proposal shall date from receipt from the Purchaser of approved general arrangement drawings and the furnishing of all further information necessary to enable the Company to proceed with the manufacture of the specified equipment.

DELAYS: The Company shall not be responsible for losses or delays caused by strikes, accidents, delays in transportation or other causes beyond its control.

ERECTION: Except when erection is included in contract price, the Company will furnish at the option of the Purchaser a competent superintendent to supervise the erection of the equipment described herein. For this superintendent's services the charges will be:

(a) __________ for each 8-hour week day; time and one-half for work in excess of 8 hours on such days and for Saturdays; double time for Sundays and Holidays; day travel time will be included.

(b) Travel and living expenses: Fare from Cleveland or from last point of assignment to Purchaser's plant and from Purchaser's plant to Cleveland or next point of assignment, provided the points of assignment are nearer than Cleveland to Purchaser's plant; living expenses to include all meals, lodging and ordinary incidental expenses.

FOUNDATIONS, ETC.: Unless otherwise specified Purchaser shall install foundations including foundation bolts and furnish all tools and supplies required for the proper erection of the equipment herein specified, and assume all responsibility for the strength of building in which equipment is to be located.

SHORTAGE AND CLAIMS: The Purchaser shall within ten days report to and have verified by delivering carrier any shortage in or damage to shipment and make claim therefor to carrier. Any other claims shall be reported to the Company within 30 days after receipt of shipment; otherwise bills of lading and packing lists shall govern settlement.

TERMS OF PAYMENT: Invoices for equipment are payable net within 30 days from date; invoices for erection superintendence and labor net 10 days from date of invoice.

TAXES: Taxes imposed by Federal, State or other taxing authority upon the manufacture, sale or use of the articles covered by our quotation and/or our invoice (Excise, Sales and Use Taxes) shall be an extra charge to be paid by the purchaser.

ACCEPTANCE: The proposal attached hereto is for immediate acceptance and is subject to change or withdrawal without notice, and is not binding on the Company until accepted at the home office by a duly authorized officer or agent of the Company.

THE W. W. SLY MANUFACTURING COMPANY
P. O. BOX 5939 CLEVELAND, OHIO 44101

5M 11-67

Printed in U.S.A.

THE W. W. SLY MANUFACTURING COMPANY

PRICE POLICY - MAY 1, 1974

Due to the unstable material prices that prevail today, we are unable to predict with any accuracy, increased costs which will be incurred between date of quotation and final shipment. To equitably serve our customers and at the same time cover these costs, the following price adjustment policy will apply to all new equipment orders:

Total FOB factory price shall be adjusted upward, if required, by use of factors determined from the U. S. Dept. of Labor, Bureau of Labor Statistics, Wholesale Price Indexes for Commodity Groups and Sub-Groups, published monthly. For all dust filters, the factor will consist of 80% of the Metals and Metal Products Group (Code 10) plus 20% of the Textile Products and Apparel Group (Code 03). For scrubbers and other products, the factor will be based on 100% of the Metals and Metal Products Group.

The adjustment factor will be determined by dividing the index for the month prior to actual shipment by the index for the month of the quotation. The adjusted price will be computed by multiplying the quoted FOB factory price by the adjustment factor.

Example

Assume scrubber quoted Jan., 1974 at $10,000, shipped April, 1974

A. Month of quotation January, 1974 -- 145.0 (Index - Code 10)
B. One month before shipment March, 1974 ---- 154.7 (Index - Code 10)

Adjustment Factor = B ÷ A = 154.7 ÷ 145.0 = 1.0669
Adjusted Price - 10,000 x 1.0669 = $10,669.00

Example

Assume dust filter quoted December, 1973, at $15,000, shipped April, 1974

Metals and Metal Products Index

A. Month of quotation December, 1973 -- 141.8 (Index - Code 10)
B. One month before shipment March, 1974 ----- 154.7 (Index - Code 10)

Textile Products & Apparel Index

C. Month of quotation December, 1973 -- 131.4 (Index Code 03)
D. One month before shipment March, 1974 ----- 136.1 (Index Code 03)

Adjustment Factor = (.80 x B ÷ A) + (.20 x D ÷ C)
= (.80 x 154.7 ÷ 141.8) + (.20 x 136.1 ÷ 131.4)
= (.80 x 1.0910) + (.20 x 1.0358)
= (.8728 + .2072) = 1.080
Adjusted Price = (15,000 x 1.080) = $16,200.00

R. G. Whitlock
Vice President,
Sales & Engineering

Form No. 2000

161-2

FLYASH RECYCLE ROTARY VALVE

161-2

BIDDER'S LIST

FLYASH RECYCLE ROTARY VALVE (161-2)

Ducon-Mikropul Ltd.
1940 Steeles Ave., East
Bramalea, Ontario
L6T 1A7

Firing Industries Ltd.
60 Picton St.
P.O. Box 230
Niagara-on-the-Lake, Ontario
L0S 1J0

Attn: Mr. Dan Feasby, P.Eng.

(BROCHURE) 61-2

DUCON-MIKROPUL LIMITED

1940 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

November 22, 1983.

Integ Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

integ
NOV 28 1983

Attention: Mr. G.R. Cooper
Project Manager

Gentlemen:

Subject: Your File: 0243-El
Energy Mines & Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Rotary Airlock - Ducon-Mikropul Proposal: S-5884

Thank you for your inquiry dated October 21st, 1983, for the supply of one Rotary Airlock handling fly ash.

As advised, we are pleased to enclose our proposal S-5884 for the said Rotary Airlock for your consideration. Our offered PERMA/flo long life solid feeder is an ideal piece of equipment for handling highly abrasive material like fly ash and would be supplied per our standard design of construction.

The Rotary Airlock will be provided with a "wye" fitting to vent blow back air from returning empty pockets after feed to the pneumatic conveying system in order to ensure fly ash flow from baghouse hopper. For further details please refer to our enclosed bulletin #4300. However, please note that there is always an operating limitation on differential pressure across the Rotary Airlock based on the type of application.

Our offered Rotary Airlock can be operated at 103 Kpa differential pressure (maximum), when feeding coarse and high density material into a pneumatic conveying system, but when the material is very fine and light in weight, like fly ash, as well as abrasive in nature, we recommend you use the Rotary Airlock for up to a maximum pressure of 30 Kpa. If the Rotary Airlock is used for a high differential pressure feed, the following may occur:-

.../2

(1) The leakage through the Airlock will be high and air will carry light fly ash through the clearance between the blades and housing which will result in wearing at a faster rate.

(2) Since the leakage is high, it would be difficult to get the desired feed rate, even with venting.

Therefore for high pressure fly ash pneumatic conveying application, we recommend that you use our PERMA/lock III Airlock, which operates without any air leakage. Our bulletin 4400 is enclosed for your further information.

We now look forward to discussing our proposal in more detail with you and to working with you to a successful completion of this project. Should you have any questions, please call the under-signed.

Yours very truly,
DUCON-MIKROPUL LIMITED.

Swapan Mitra
Engineering Sales.

Enclosures.

/jv

161-2

RE

DEC 12 1983

INTEG VCR

DUC-MIK BMTN

DECEMBER 12, 1983   TELEX NO: B-4263

ATTN: G.R. COOPER

SUBJECT: ENERGY MINES AND RESOURCES CANADA
          ROTARY AIRLOCK
          DUCON-MIKROPUL PROPOSAL S-5884

FURTHER TO OUR PROPOSAL S-5884 DATED NOVEMBER 22, 1983 REGARDING FLY ASH ROTARY AIRLOCK, WE HAVE REVIEWED THIS APPLICATION ONCE AGAIN AND FEEL THE ROTARY AIRLOCK WILL NOT SUFFER UNDUE ABRASION DUE TO THE LIGHT FLY ASH LOADING.

REGARDS,

SWAPAN MITRA.

INTEG VCR

DUC-MIK BMTN

EQUIPMENT SPECIFICATION

One (1) only Ducon-Mikropul 4" PERMA/flo Type: B Rotary Airlock of cast iron construction, with adjustable Permalloy (550 Brinell) rotor and shoe. Unit features outboard bearings, air purge hubs, packing gland seals, over size rotor, rotor shaft and "wey" fittings for air venting. The Rotary Airlock is also complete with a S.C.R. variable speed drive complete with the following features:-

- Mini Pak plus controller.
- Remote operator station to include speed potentiometer.
- Blank panel.
- Remote operator kit.
- 1/2 H.P., D.C. motor, 1750 rpm with 90V armature, 50/100 volt field, T.E.F.C. enclosure complete with breather drain.
- Field supply kit.
- Euro drive parallel (helical) gear reducer.
- Speed pick-up unit complete with digital tachometer.

SCHEDULE I - SCHEDULE OF PRICES

FLYASH ROTARY AIRLOCK VALVE

1.	One (1) rotary airlock valve as described in the specification, FOB point of sale	$ 6,902.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ INCLUDED
3.	Transportation to site	$ 200.00 (Estimated)
	TOTAL	$ 7,102.00

Our price is based on:-

F.O.B.: Point of manufacture.

Delivery: 2 - 2½ months.

All Taxes: Extra.

Terms: Net thirty (30) days.

SCHEDULE II - TECHNICAL DATA

FLYASH RECYCLE ROTARY VALVE

1. SPECIFICATIONS

Manufacturer's name	DUCON-MIKROPUL LIMITED	
Vendor's name	DUCON-MIKROPUL LIMITED	
Airlock model and type	4" PERMA/flo Type: B	
Airlock weight	182 approximately	kg
Airlock outside dimensions	Per Bulletin	mm
Flange size	Per Bulletin	mm
Capacity - minimum	m³/rev @ rpm	
maximum	.00164 m³/rev @ rpm	
Airlock motor -		
Manufacturer	RELIANCE	
Enclosure type	T.E.F.C.	
Output	.38	kW
Speed	1750	rpm
Temperature rise	N/A	°C
Frame size	U56HC	
Airlock drive -		
Type	EURODRIVE	
Manufacturer	EURODRIVE	
Speed Ratio	148.85:1	
Power supply voltage	____ VA 115 V 1	phase

2. LIST OF ALTERNATIVES AND EXTRAS

3. DELIVERY

Time required for manufacture and shipment from receipt of order 2 - 2½ months

645

CONDITIONS OF SALE AND WARRANTY

GENERAL:

A) All purchase orders are subject to acceptance by the home office of Ducon-Mikropul Ltd. as evidenced by a signed acknowledgement which will be forwarded to the purchaser.

B) The contract is entered into at the factory of the seller in Bramalea where the order based hereon is accepted. The entering into, construction, interpretation, performance and discharge of this contract will be governed by the laws of Ontario.

C) In case performance hereunder by the Company shall be delayed or rendered impossible by force majeure, including war, governmental authority, embargoes, prohibition of or restriction on exports or imports, civil commotions, labor difficulties, accidents, loss or damage by act of God or the elements, intereferences with transportation, closing or interruption of customary short routes of transportation or any other contingency beyond the Company's control and whether herein specifically enumerated or not in the connection with the production or transportation of the equipment which is the subject of this order expected arrival shall be extended for a period equal to the duration of the contingency and for a sufficient time thereafter in which to make shipment. The Company shall in no event be held responsible for any contingency beyond its control whether herein specifically provided for or not.

PAYMENT AND SALES TAX:

A) Prices to not include any present or future local, provincial or federal excise, sale privilege or uses taxes. The amount of such taxes will be added to the sales price if the Company is required to pay them.

B) Title to the equipment shall pass to the purchaser upon delivery to the carrier.

C) Prorata payments will become due as shipment is made. If shipments are delayed by the purchaser, payment shall become due on the date the Company is prepared to make shipment. Equipment held for the purchaser shall be at the risk and expense of the purchaser.

D) In the event the purchaser defaults on any payment, or in the event the financial responsibility of the purchaser becomes impaired or unsatisfactory to the Company, the full amount of all payments required hereunder which are unpaid shall, at the election of the Company, become immediately due and payable. Upon default of the purchaser in complying with the terms of the payment hereof, the Company may take immediate possession of any equipment delivered to the purchaser pursuant to the within purchase order without legal process, without demand and for this purpose the Company may enter any premises where said equipment may be found and remove same.

CANCELLATION:

Cancellation of orders accepted by the Company can be made only with the Company's consent. The purchaser shall pay the full purchase price for all items completed. On such items that are not completed, a charge will be made for materials used and labor costs together with sales engineering and administrative overhead plus profit as per the original purchase order. A minimum charge of 10% of purchase price for cancellation will apply.

WARRANTY:

A) Materials:

The Company warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in material and workmanship under normal use and service for twelve (12) months after shipment (except filter tubes - ninety (90) days). This warranty does not cover products, accessories, parts of attachments which are not manufactured by the Company and shall receive only such warranty, if any, as given by the manufacturer thereof. Warranty does not apply where undue wear or breakage is caused by careless or improper handling or where defects are remedied by others or when operating instructions are not adhered to. The Company shall have the option to require the return of any alleged defective part, transportation prepaid, to establish the claim. If the Company's examination shall disclose such parts to have been so defective, the Company will repair or replace said part for the purchaser, f.o.b. Company's plant. The Company's liability in this warranty is limited to the above and in no case can exceed the purchase price of the equipment involved. In no event shall the Company be liable for any consequential damages, secondary charges, expenses or such resulting from any alleged defect.

Any repairs or substitutions made by the purchaser without the written consent of the Company will void all warranties. The Company will not allow charges made by the purchaser for repairs and alterations without written consent or approval from the Company.

IT IS UNDERSTOOD THAT THE COMPANY ASSUMES NO RESPONSIBILITY FOR THE SELECTION OF CONSTRUCTION MATERIALS FOR RESISTANCE TO AND THE EFFECTS OF CORROSION AND/OR EROSION.

B) Performance:

No warranty, either oral, written or implied, as to performance of equipment supplied is extended unless specifically stated on the face of the acknowledgement.

SHIPMENT:

A) Special loading, crating or boxing specified by the purchaser will be charged at an additional cost.

B) The Company assumes no responsibility for loss or damage incurred in transit. Claims for such loss or damage should be filed by the purchaser with the carrier.

C) Shipments are normally made charges collect and routed as per the purchaser's instructions unless approval is obtained from purchaser for rerouting to best suit commodity covered. If not specified, shipment will be made via "Best Way" at the Company's convenience. The Company reserves the right to make partial shipments and cannot guarantee the extent of assembly of component parts which will vary depending upon the method of shipment used unless specifically covered on the face of this acknowledgement.

INSTALLATION:

The equipment furnished by the Company will be installed by and at the expense of the purchaser. Competent field supervision can be supplied by the Company on a per diem rate plus living and traveling expenses.

FOUNDATIONS AND AUXILIARIES:

In no case will the Company design and detail foundation or provide foundation bolts. Unless otherwise specified, structural supports, stairways, access ladders, platforms, insulation and attachment, connecting duct work, bolts and gaskets for attaching thereto are not included.

SAFETY DEVICES:

No special safety devices are included unless specified to the contrary.

PATENTS:

The Company agrees to defend any suits brought against purchaser for alleged infringement due to construction or design of Company's machinery provided we are immediately informed in writing on receipt of said charges and provided we are given complete control of the defense and also that we have the right to defend or settle the carge or to make necessary changes in the equipment to avoid infringement. We do not agree to defend infringement suits involving accessories not of Company's manufacture or suits based on use of equipment in combination with other equipment or suits involving process patents.

STANDARD SHOP PRACTICE:

All equipment will be cleaned of dirt, loose scale, and spatter. Carbon steel materials will be given one coat of primer unless additional painting is specified in purchaser's order in which case we will advise you of additional charges if applicable

The Company reserves the right to make minor changes or improvements in design and construction.

The Company welcomes purchaser's inspection of materials and workmanship of our equipment in the shop provided such inspection and acceptance does not result in undue delay. If special tests, inspection procedures or pre-assembly resulting in additional expense or delay are specified by the purchaser, the Company will promptly advise the extra charge involved which will be added to the purchase price.

DUCON-MIKROPUL LTD. 1940 STEELES AVE. E., BRAMALEA

(BROCHURE) 161-2

FIRING INDUSTRIES LTD./LTEE
equipment for the process industries
équipement pour les industries de transformation

FIRING

MONTREAL 6600 TRANS CANADA HWY. SUITE 750
POINTE CLAIRE H9R 4S2
TEL. (514) 697-5644 TLX 05-821762

HEAD OFFICE 67 PICTON ST. P.O. BOX [illegible]
NIAGARA ON THE LAKE ONTARIO [illegible]
TEL. (416) 468-3172 TLX [illegible]

November 16, 1983

integ
NOV 18 1983
GH
FILE

INTEG
INTERCONTINENTAL ENGINEERING LTD.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G. R. Cooper, P. Eng.
Project Manager

Subject: ENERGY MINES & RESOURCES CANADA
Combustion Research Facility
Equipment Cost Estimate
File 0243-E1
Inquiry Nos. 241-2, 161-2, 222-1, 211-1, 221-1

Gentlemen:

Based on the inquiries listed above, and our recent telephone conversation, we are pleased to submit our budget proposal to supply the following equipment subject to the terms and conditions below delivered to Ottawa, Ontario.

This proposal is a budget estimate based on standard equipment and on our standard terms and conditions. These features, terms and conditions are negotiable but any changes may result in price increases.

This proposal is subject to a detailed review of the technical specifications at the time of tendering.

~~ITEM I - INQUIRY 241-2~~

~~ROTARY AIRLOCK VALVE FOR FUEL AND SORBENT FEED SYSTEM~~

~~APPLICATION~~

~~To feed fuel from a pressurized feed screw into the combustor feed chute as generally described in your specification 241-2.~~

~~We have assumed that the flow rate of the material is controlled upstream of the rotary valve and that the valve is used only as an airlock.~~

~~The maximum operating temperature for this airlock would be 450° F.~~

....2

~~EQUIPMENT~~

~~ONE (1) PREMIER PNEUMATICS AEROLOCK Model MDRFS-76-10H-1-P as generally described in the attached brochure and with the following features:~~

- ~~Drop-thru style housing with a round inlet/outlet.~~
- ~~Cast iron alloy housing construction.~~
- ~~10-blade steel closed hub rotor.~~
- ~~Standard tipped rotor blades.~~
- ~~Class 5 rotor clearance for operation at 450°F.~~
- ~~Lip style shaft seals.~~
- ~~High temperature packing gland shaft seals.~~
- ~~Full rotor pocket capacity 0.09 cu.ft./rev.~~
- ~~Motor drive pre-assembled including:~~
- ~~1/2 HP Right SCR Variable Speed motor 115 volt-1-phase-60 cycle with explosion proof enclosure.~~
- ~~Totally enclosed OSHA drive guard.~~
- ~~Industrial roller chain reduction drive for final rotor speed of 15 RPM.~~

~~BUDGET PRICE, ex taxes, delivered.............Approx.$4,500.00~~

~~SHIPMENT: 6-8 weeks~~

ITEM II - INQUIRY 161-2

ROTARY AIRLOCK FOR FLYASH

APPLICATION

To discharge flyash from a baghouse into a pneumatic conveying system.

We have assumed that the capacity of this airlock is not critical and that a rated capacity of approximately 0.045 cu.ft./rev. and 12 RPM would be acceptable.

The outlet transition would be a standard 2" connection.

EQUIPMENT

ONE (1) PREMIER PNEUMATICS AEROLOCK Model MDRFS-76-10H-1P as generally described in the attached brochure and with the following features:

- Drop-thru style housing with a round inlet/outlet.
- Cast iron alloy housing construction.
- 10-blade steel, closed hub rotor with 50% reduced pockets.
- Standard tipped rotor blades.
- Class 5 rotor clearance for 450° F. operating temperature.
- Lip style shaft seals.
- High temperature packing gland shaft seals.
- Motor drive pre-assembled including:
- 1/2 HP SCR Variable Speed motor 115 volt-1-phase-60 cycle with TEFC rated enclosure.
- Totally enclosed OSHA drive guard.
- Industrial roller chain reduction drive.
- Aerolock Outlet Transition.
- Model HA-R-S-Sch.40-76.
- Standard style.
- Round inlet flange.
- Carbon steel fabricated construction.
- 2" Sch. 40 pipe line connection.

BUDGET PRICE, ex taxes, delivered...........Approx.CAN.$3,900.00

.....4

FIRING INDUSTRIES LTD.

CONDITIONS OF SALE

PRICES AND ACCEPTANCE: This quotation may be voided unless executed by you within thirty days from date of proposal. Prices on this quotation are based on foreign exchange, sales taxes, customs tariff and other direct taxes in effect at date of quotation. Orders based on this quotation are accepted at prices subject to change in foreign exchange, sales tax, customs tariff and other direct taxes beyond our control between time of quotation and shipment.

Prices and terms of payment are firm. Terms are 30 days from date of shipment unless otherwise specified in proposal. Interest will be charged on overdue accounts at 24% per annum calculated on a per diem basis. Unless specifically agreed to by us in writing, hold-backs will not be accepted.

PURCHASE ORDERS: Acceptance of all purchase orders is with the mutual understanding that the terms and conditions of this quotation shall apply and prevail over any inconsistent provisions of any such purchase order. All orders are subject to our approval in respect to credit.

DRAWINGS: Drawings will be submitted for approval N/A weeks after receipt of an order. Drawings must not be reproduced or information contained therein transmitted in any manner, directly or indirectly in any way detrimental to our interest. All rights of design and invention are reserved.

DELIVERY: Delivery of products is f.o.b. Ottawa, Ont.
Claims for shortage or damage on shipments must be made immediately against the carrier by the purchaser. The time of delivery is approximate only and is the date of shipment from the factory or warehouse and is based upon date of receipt of approved drawings. In the event of any delay in delivery caused by strikes, accidents, government regulations, delays in transportation, or other causes beyond our control, the delivery shall be extended for a period equal to the time lost by reason of the delay. We accept no responsibility for costs or consequential damages due to failure to deliver as scheduled. If shipments are delayed by the purchaser, payments shall become due as if shipment had been made on dates specified by the purchaser.

TITLE: The title to and right of possession of the equipment remains with us until the contract price has been paid in full by the purchaser.

CANCELLATION CHARGES: Orders may be cancelled only with our approval. A minimum cancellation charge of 15% of the total selling price will be made for any cancellation. This charge will increase accordingly if expenses have been accrued beyond the 15% minimum stated above.

.....2

WARRANTY: Parts proven to be defective within twelve months after shipment will be repaired or, at our option, replaced free of charge f.o.b. factory or origin upon receipt of defective parts at the factory, transportation charges prepaid. It is expressly understood that our liability under this warranty is limited to the furnishing of such replacement parts. We will make no allowance for repair, alterations or other work done, unless specifically agreed to in writing. Goods returned for credit will not be accepted unless the return is authorized by us in writing, and approved returns will be subject to a 15% re-stocking charge. We shall not be liable for consequential damages such as loss of profit, delays, expense or damage, nor for any implied warranties, or warranties other than those set forth herein. Our responsibility for machinery and/or equipment manufactured by others and supplied by us, under this proposal is limited to the guarantee furnished to us by such manufacturers. This warranty does not apply to damages or deterioration of equipment through abrasion or corrosion.

PERFORMANCE: While the equipment quoted is to the best of our knowledge adequate for the intended service as we understand it, no guarantee is undertaken by us unless specifically stated in the proposal.

PERMITS, LICENSES: Purchaser is responsible for the costs and the obtaining of any permits and licenses required for the installation and operation of the offered equipment, including CSA and local hydroelectric approvals.

INSTALLATION COSTS: Prices quoted include only the supply of the specified equipment. No installation or erection costs are included.

TECHNICAL SERVICE: Service and start-up assistance is available at $375.00 per 8-hour day plus reasonable travel and living expenses at cost.

****

March 1983

162-1
FLYASH RECYCLE PIPING

[illegible] 162

ADDITIONAL ESTIMATE

DUCON MIKRO

DUCON-MIKROPUL LIMITED

1940 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

December 12, 1983.

Integ Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

integ
DEC 19 1983
G.C.

Attention: Mr. G.R. Cooper

Gentlemen:

Subject: Your Inquiry No: 161-3
Project: 0243
Energy Mines & Resources Canada
ARFBC Research Facility
Ducon-Mikropul Proposal: S-5897

As requested, we are pleased to submit our price for a Fly Ash Pneumatic Conveying System for your consideration.

We have designed a Dilute Phase Pressure Conveying System based on your specifications and sketch 161-3.

The Fly Ash, collected in the Baghouse, will be fed to the pressure Conveying System through a Rotary Airlock for reinjection to your Combuster.

The System is supplied with a diverter valve to by-pass the fly ash to a sample receiver, in order to enable you to obtain the fly ash sample for testing, when required.

Item #1: Pipes & Fittings:

One (1) Lot Fly Ash Conveying Pipes & Fittings comprising of the following:-

- 2" dia. 35'-0" long SCHED.80 straight pipes.
- One Ducon-Mikropul 2" size Perma/loy "Y" piece.
- Three Ducon-Mikropul 2" size 45° Perma/flo integral wear back elbows.
- One Ducon-Mikropul 2" size 90° Perma/flo integral wear back elbow.
- One Ducon-Mikropul Perma/flo material pick-up "Tee".
- Sixteen 2" size pipe couplings.

For Perma/flo fittings, refer to our bulletin 4102D.

.../2

053

Item #2: Diverter Valve:

One (1) only Three-Way Diverter Valve, stainless steel construction complete with pneumatic cylinder, solenoid, linkage, limit switches and suitable for 1950°F temperature.

TOTAL PRICE .... $ 10,636.00

Our price is based on:-

F.O.B.: Bramalea, Ontario.

All Taxes: Extra.

Delivery: Three (3) to four (4) weeks after approval.

Terms: Net thirty (30) days.

Estimated Freight To Site: $150.00

The following items are not included:-

- Inspection.
- Pipe hangers.
- Control panel.
- Electrical work.

We trust you will find our proposal to your entire satisfaction. Should you have any questions, please do not hesitate to call the under-signed.

Yours very truly,
DUCON-MIKROPUL LIMITED

Swapan Mitra
Engineering Sales.

Encl: Bulletin 4102D.

/jv

CONDITIONS OF SALE AND WARRANTY

GENERAL:

A) All purchase orders are subject to acceptance by the home office of Ducon-Mikropul Ltd. as evidenced by a signed acknowledgement which will be forwarded to the purchaser.

B) The contract is entered into at the factory of the seller in Bramalea where the order based hereon is accepted. The entering into, construction, interpretation, performance and discharge of this contract will be governed by the laws of Ontario.

C) In case performance hereunder by the Company shall be delayed or rendered impossible by force majeure, including war, governmental authority, embargoes, prohibition of or restriction on exports or imports, civil commotions, labor difficulties, accidents, loss or damage by act of God or the elements, intereferences with transportation, closing or interruption of customary short routes of transportation or any other contingency beyond the Company's control and whether herein specifically enumerated or not in the connection with the production or transportation of the equipment which is the subject of this order expected arrival shall be extended for a period equal to the duration of the contingency and for a sufficient time thereafter in which to make shipment. The Company shall in no event be held responsible for any contingency beyond its control whether herein specifically provided for or not.

PAYMENT AND SALES TAX:

A) Prices to not include any present or future local, provincial or federal excise, sale privilege or uses taxes. The amount of such taxes will be added to the sales price if the Company is required to pay them.

B) Title to the equipment shall pass to the purchaser upon delivery to the carrier.

C) Prorata payments will become due as shipment is made. If shipments are delayed by the purchaser, payment shall become due on the date the Company is prepared to make shipment. Equipment held for the purchaser shall be at the risk and expense of the purchaser.

D) In the event the purchaser defaults on any payment, or in the event the financial responsibility of the purchaser becomes impaired or unsatisfactory to the Company, the full amount of all payments required hereunder which are unpaid shall, at the election of the Company, become immediately due and payable. Upon default of the purchaser in complying with the terms of the payment hereof, the Company may take immediate possession of any equipment delivered to the purchaser pursuant to the within purchase order without legal process, without demand and for this purpose the Company may enter any premises where said equipment may be found and remove same.

CANCELLATION.:

Cancellation of orders accepted by the Company can be made only with the Company's consent. The purchaser shall pay the full purchase price for all items completed. On such items that are not completed, a charge will be made for materials used and labor costs together with sales engineering and administrative overhead plus profit as per the original purchase order. A minimum charge of 10% of purchase price for cancellation will apply.

WARRANTY:

A) Materials:

The Company warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in material and workmanship under normal use and service for twelve (12) months after shipment (except filter tubes - ninety (90) days). This warranty does not cover products, accessories, parts of attachments which are not manufactured by the Company and shall receive only such warranty, if any, as given by the manufacturer thereof. Warranty does not apply where undue wear or breakage is caused by careless or improper handling or where defects are remedied by others or when operating instructions are not adhered to. The Company shall have the option to require the return of any alleged defective part, transportation prepaid, to establish the claim. If the Company's examination shall disclose such parts to have been so defective, the Company will repair or replace said part for the purchaser, f.o.b. Company's plant. The Company's liability in this warranty is limited to the above and in no case can exceed the purchase price of the equipment involved. In no event shall the Company be liable for any consequential damages, secondary charges, expenses or such resulting from any alleged defect.

Any repairs or substitutions made by the purchaser without the written consent of the Company will void all warranties. The Company will not allow charges made by the purchaser for repairs and alterations without written consent or approval from the Company.

IT IS UNDERSTOOD THAT THE COMPANY ASSUMES NO RESPONSIBILITY FOR THE SELECTION OF CONSTRUCTION MATERIALS FOR RESISTANCE TO AND THE EFFECTS OF CORROSION AND/OR EROSION.

B) Performance:

No warranty, either oral, written or implied as to performance of equipment supplied is extended unless specifically stated on the face of the acknowledgement.

SHIPMENT:

A) Special loading, crating or boxing specified by the purchaser will be charged at an additional cost.

B) The Company assumes no responsibility for loss or damage incurred in transit. Claims for such loss or damage should be filed by the purchaser with the carrier.

C) Shipments are normally made charges collect and routed as per the purchaser's instructions unless approval is obtained from purchaser for rerouting to best suit commodity covered. If not specified shipment will be made via "Best Way" at the Company's convenience. The Company reserves the right to make partial shipments and cannot guarantee the extent of assembly of component parts which will vary depending upon the method of shipment used unless specifically covered on the face of this acknowledgement.

INSTALLATION:

The equipment furnished by the Company will be installed by and at the expense of the purchaser. Competent field supervision can be supplied by the Company on a per diem rate plus living and traveling expenses.

FOUNDATIONS AND AUXILIARIES:

In no case will the Company design and detail foundation or provide foundation bolts. Unless otherwise specified, structural supports, stairways, access ladders, platforms, insulation and attachment, connecting duct work, bolts and gaskets for attaching thereto are not included.

SAFETY DEVICES:

No special safety devices are included unless specified to the contrary.

PATENTS:

The Company agrees to defend any suits brought against purchaser for alleged infringement due to construction or design of Company's machinery provided we are immediately informed in writing on receipt of said charges and provided we are given complete control of the defense and also that we have the right to defend or settle the carge or to make necessary changes in the equipment to avoid infringement. We do not agree to defend infringement suits involving accessories not of Company's manufacture or suits based on use of equipment in combination with other equipment or suits involving process patents.

STANDARD SHOP PRACTICE:

All equipment will be cleaned of dirt, loose scale, and spatter. Carbon steel materials will be given one coat of primer unless additional painting is specified in purchaser's order in which case we will advise you of additional charges if applicable

The Company reserves the right to make minor changes or improvements in design and construction.

The Company welcomes purchaser's inspection of materials and workmanship of our equipment in the shop provided such inspection and acceptance does not result in undue delay. If special tests, inspection procedures or pre-assembly resulting in additional expense or delay are specified by the purchaser, the Company will promptly advise the extra charge involved which will be added to the purchase price.

Z⊕
INTEG VCR

DUC-MIK BMTN

FEBRUARY 7, 1984 TELEX NO: B-180

RECEIVED
FEB 07 1984
FILE

ATTENTION: G.R. COOPER

SUBJECT: YOUR INQUIRY NO. 161-3
PROJECT 0243
ENERGY MINES AND RESOURCES CANADA
DUCON-MIKROPUL PROPOSAL S-5897

AS DISCUSSED, WE ARE PLEASED TO CONFIRM THAT IF THE TEMPERATURE OF COMBUSTER BACK PRESSURE GAS IS NOT HIGHER THAN 100 DEGREES CELCIUS A STANDARD DIVERTER VALVE WILL BE ADEQUATE AND THAT WILL REFLECT A TOTAL DEDUCTION OF 3,000.00 DLRS. FROM THE SYSTEM PRICE.

BEST REGARDS,

SWAPAN MITRA.

⊕
INTEG VCR

DUC-MIK BMTN

171-1
I.D. FAN

171-1

BIDDER'S LIST

INDUCED DRAFT FAN (171-2)

B & D Engineering Sales Ltd.
2402 Shell Road
Richmond, B.C.
V6X 2P1

Beckland Equipment Ltd.
3118 Beta Avenue
Burnaby, B.C.
V5G 4K4

Attention: Mr. W. Massey

Olympic International Agencies Ltd.
145 Riverside Drive
North Vancouver, B.C.
V7H 1T6

Attention: Mr. A. Fong

171-1

beckland
equipment
LTD

integ
DEC - 1 1983
DATE
GRC
FILE

November 22, 1983

Integ Engineering Ltd.
1155 W. Pender St.
Vancouver, B. C.
V6E 2P4

Attention: Mr. Grant Cooper

Subject: Project 0243 Inquiry 171-1
ARFBC Research Facility
Quotation 84-11-35

Gentlemen;

With reference to the above inquiry we are pleased to offer the following Joy fan for your consideration:

One - Joy 275-10 design 5B pressure blower, arrangement 8 with motor on integral base and complete with:

- 25 HP/TEFC motor
- flanged inlet/outlet
- shaft seal
- cooling wheel
- flexible coupling
- coupling guard
- oil lubricated bearings
- inlet silencer
- outlet silencer

PRICE:	$ 8,225.00
Freight costs to Ottawa	$ 145.00

Price is F.O.B. Winnipeg, freight allowed to Ottawa, all taxes extra and net 30 day terms. Delivery is 12 - 14 weeks from drawing approval.

We trust the above is in order and that you will contact the undersigned for any additional information required.

Yours truly,
BECKLAND EQUIPMENT LTD.

Bill Massey

Wm. S. Massey
WSM/df

Encl.

3250 BETA AVENUE, BURNABY, B.C. c/o Mr. Vaughn Joy, Winnipeg / TEL. 299-8808 • TELEX 04-354736 (BECKLAND VCR)

SCHEDULE I - SCHEDULE OF PRICES

INDUCED DRAFT FAN

1.	Induced draft fan as described in the specification, FOB point of sale	$ 8225.00
2.	Canadian Customs Duty _____ % of $ __________	$ N/A
3.	Transportation to site	$ 145.00
	TOTAL	$ 8370.00

SCHEDULE II - TECHNICAL DATA

INDUCED DRAFT FAN

1.0 SPECIFICATIONS

Manufacturer's name	JOY MANUFACTURING COMPANY CANADA LTD.	
Vendors name	BECKLAND EQUIPMENT LTD.	
Model and type	275 - 10" DESIGN 5B PRESSURE BLOWER	
Volume	.59	m^3/s
Discharge pressure	8.68	kPa(g)
Blower RPM	3500	
Diameter of suction	254	mm
Diameter of discharge	254	mm
Maximum power consumption	8.21	kW
Minimum flow	.59	m^3/s
Maximum noise level	85	dBA
Drive type and specification	DIRECT	
Motor		
- Manufacturer	C.G.E.	
- Enclosure type	TEFC	
- Power output	18.65	kW
- Speed	3600	rpm
- Temperature rise	40	°C
- Frame size	284	
Net weight (MOTOR & FAN)	660	kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

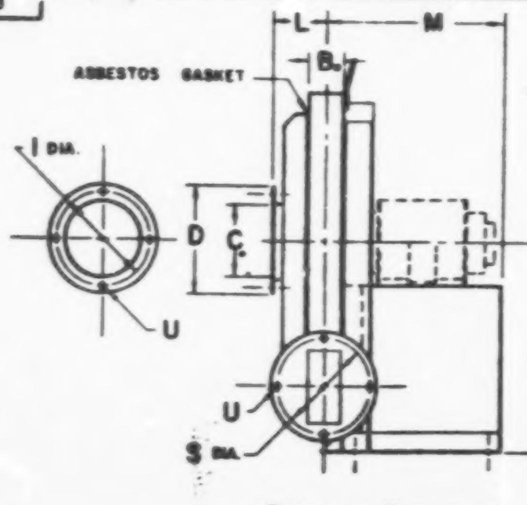
N/A

3.0 DELIVERY

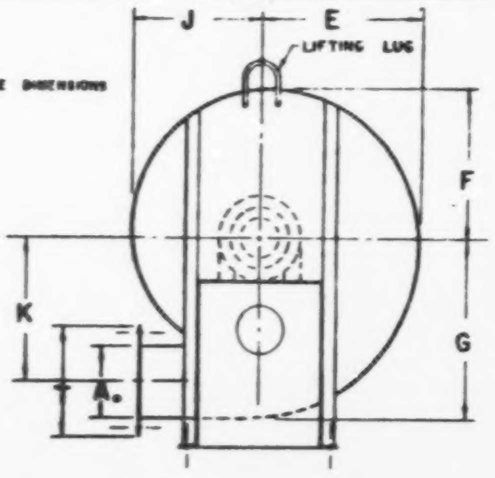
Time required for manufacture
and shipment from receipt of
order FROM DRAWING APPROVAL 12 - 14 WEEKS ~~months~~

2118

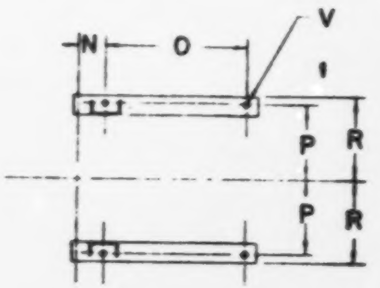
11



DISCHARGE ELEVATION

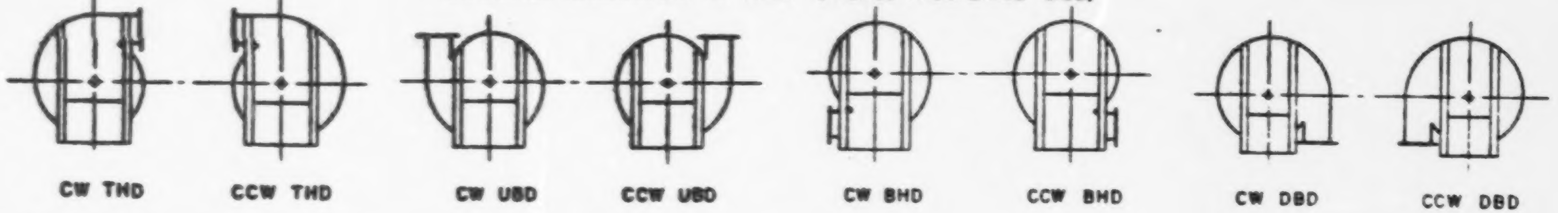


DRIVE SIDE ELEVATION



BASE BOLTING PLAN

DISCHARGE DESIGNATION OF FANS (VIEWED FROM DRIVE SIDE)



FAN SIZE	A.	B.	C.	D	E	F	G	H				I	J	K	L	M	N	O	P	R	S	T	U		V
								THD	UBD	BHD	DBD												DIA	QTY	DIA
146-5	4 21/32	1 1/8	4 9/16	7 1/2	10 9/16	9 13/16	12	11 1/2	12 1/2	14 3/8	12 1/2	6 1/2	8 13/16	9 1/16	3 9/16	10 11/16	1 11/16	7 1/4	5 1/4	5 1/8	6 1/8	7 1/8	3/8	4	7/16
165-6	5 7/16	1 1/4	5 1/2	8	12 1/8	11 3/16	13 3/8	12 3/8	13 3/8	16 1/8	13 1/2	7	10	10 1/2	3 5/8	11 7/8	1 3/4	8 1/2	6	6 5/8	7 1/4	8 1/4	3/8	4	7/16
185-6	6 1/16	1 13/32	6 1/8	8 3/8	13 3/8	12 7/16	14 15/16	14	15 1/8	17 7/8	14 3/8	7 5/8	11 1/8	11 3/4	4 5/16	13 9/16	2 5/16	9 1/4	6 5/8	7 1/4	8 1/4	9 1/4	1/2	4	7/16
205-8	6 9/16	1 9/16	6 7/8	9 1/4	15 1/16	13 7/8	16 11/16	15 3/8	17	19 3/4	16	8 3/8	12 7/16	13 1/8	4 1/2	17 27/32	2 3/8	13 1/2	7 1/8	8 1/4	9 1/8	10 1/8	7/16	6	9/16
225-8	7 9/32	1 3/4	7 11/16	10 1/2	17 1/16	15 9/16	18 3/8	17	18 1/2	21 3/8	17 1/2	9 3/8	13 13/16	14 11/16	5	18 3/4	2 1/2	14 3/8	8 1/8	9 1/4	10	11	7/16	6	9/16
245-8	8 1/2	1 31/32	8 9/16	11 1/4	19	17 3/16	20 9/16	19	20 1/2	24	19	10 3/16	15 9/16	16 7/16	5 21/32	20 7/32	2 11/16	16 3/16	10 7/16	11 1/8	10 3/8	12	7/16	6	9/16
275-10	9 7/16	2 3/16	9 3/8	12 3/8	21 1/8	19 1/16	23 1/8	21	22 3/8	26 3/8	20 3/8	11 3/8	17 3/8	18 3/8	5 13/16	20 15/16	2 3/4	17	11 3/16	12	11 3/4	13	7/16	6	9/16
305-10	10 19/32	2 15/32	10 3/8	13 3/8	23 9/16	21 3/8	26	23 1/8	25 1/2	29 1/4	22 3/8	12	19 7/16	20 1/2	5 15/16	23 9/32	2 15/16	19 1/2	12 7/16	13 1/4	13 1/4	14 1/2	7/16	8	9/16
365-12	11 9/16	2 3/4	12	14 3/8	26 3/16	24 1/8	29	26	28 1/2	32 1/2	25	13 3/8	21 11/16	23	6 1/8	24 3/8	3 1/16	21	13 7/16	14 1/8	14 3/8	16	7/16	8	9/16

1 BASE DIMENSIONS REVISED TO 2117 C.A.

JOY MANUFACTURING CO

PRESSURE BLOWERS
ARR 4 FIXED DISCHARGE DES 38 HALF WIDTH
EDM 11/7/63
N.T.S.
2118

FAN TO BE SUPPLIED WILL HAVE AN EXTENDED BASE

(NOISE ANALYSIS INCL.) 171-1

NORTHERN BLOWER INC

901 REGENT AVENUE WEST, WINNIPEG, MANITOBA, CANADA R2C 3A9
TELEPHONE 222-4216, AREA CODE 204
TELEX 07-57518

REPLY TO: OLYMPIC INTERNATIONAL AGENCIES LTD.
145 RIVERSIDE DRIVE, NORTH VANCOUVER, B.C. V7H 1T6, TELEPHONE (604) 929-3426, TELEX 04-352543

INTEG-INTERCONTINENTAL ENGINEERING LTD.,
1155 West Pender Street,
Vancouver, B. C.
V6E 2P4.

November 14, 1983.

integ
NOV 16 1983

Attention: G. R. Cooper.

Reference: ENERGY MINES & RESOURCES, CANADA.
Atmospheric Re-Circulating Fluidized
Bed Combustion Research Facility.
Equipment Cost Estimate.
Your File Ref. #0243-E1.

Gentlemen:

We are pleased to submit our fan selection, pricing and technical information, in response to your enquiry No. 171-1, which we received October 28, 1983.

ONE (1) CML NORTHERN BLOWER Design 55, Turbo Pressure Blower, Size 2T-15-32, with steel wheel, Arrangement 8, complete with :-

- Integral fan and motor base.
- Flanged inlet.
- Flanged outlet.
- Shaft seal.
- Cooling wheel.
- 60 TIO coupling.
- Osha coupling guard.
- Osha shaft and bearing guard.
- Extended grease lines.
- 20 h. p., 3600 rpm, 3/60/575
  TEFC complete with Class B insulation
  and removable drain plug.
- Coupling and motor mounted.

..../continued.... (2)

NORTHERN
BLOWER INC

901 REGENT AVENUE WEST, WINNIPEG, MANITOBA, CANADA R2C 3A9
TELEPHONE 222-4216, AREA CODE 204
TELEX 07-57518

REPLY TO: OLYMPIC INTERNATIONAL AGENCIES LTD
145 RIVERSIDE DRIVE, NORTH VANCOUVER, B.C. V7H 1T6, TELEPHONE (604) 929-3426, TELEX 04-352543

INTEG-INTERCONTINENTAL ENGINEERING LTD. November 14, 1983.

Page (2).

PERFORMANCE : 0.586 Am^3/s, 8.7 kPa g,
3540 rpm, 10.15 Kw @ 177°C.
0.809 Kg/Am-3 density.

PRICE EACH $4,820.00

All sales taxes extra.
F. O. B. Winnipeg, Manitoba.

ENCLOSURE(S) :
(4) copies Drawing CC5981 Fan Curve.
(4) copies Drawing CU33593, Fan Drawing.
(4) Copies Sound Level.

NOTE Silencer not included.

Yours very truly,
OLYMPIC INTERNATIONAL AGENCIES LTD.,
Agents: CML NORTHERN BLOWER INC.

Anthony Fong.

Anthony Fong.

AF : emg

SCHEDULE I - SCHEDULE OF PRICES

INDUCED DRAFT FAN

1.	Induced draft fan as described in the specification, FOB point of sale	$ 4,820.00 f.o.b. Winnipeg, All taxes extra.
2.	Canadian Customs Duty _____ % of $ __________	$ - - -
3.	Transportation to site	$ 260.00 To Ottawa.
	TOTAL	$ 5,080.00 All taxes extra.

NOTE

Silencer not included in price.

SCHEDULE II - TECHNICAL DATA

INDUCED DRAFT FAN

1.0 SPECIFICATIONS

Manufacturer's name	CML NORTHERN BLOWER INC.	
Vendors name	OLYMPIC INTERNATIONAL AGENCIES LTD.	
Model and type	DESIGN 55, SIZT 2T-15-32	
Volume	0.586	m^3/s
Discharge pressure	8.7	kPa(g)
Blower RPM	3,540	
Diameter of suction	254	mm
Diameter of discharge	305	mm
Maximum power consumption	Please refer to Fan Curve No. CC 5981	kW
Minimum flow	CC5981	m^3/s
Maximum noise level	93 @ 1 m, inlet in + out	dBA
Drive type and specification	Falk Coupling 60T10	
Motor		
- **Manufacturer**	WESTINGHOUSE, BALDOR, GEC, AT CML OPTION	
- **Enclosure type**	TEFC	
- **Power output**	15	kW
- **Speed**	3600	rpm
- **Temperature rise**	--	°C
- **Frame size**	256T	
Net weight (Fan & Motor).	650	kg

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

____

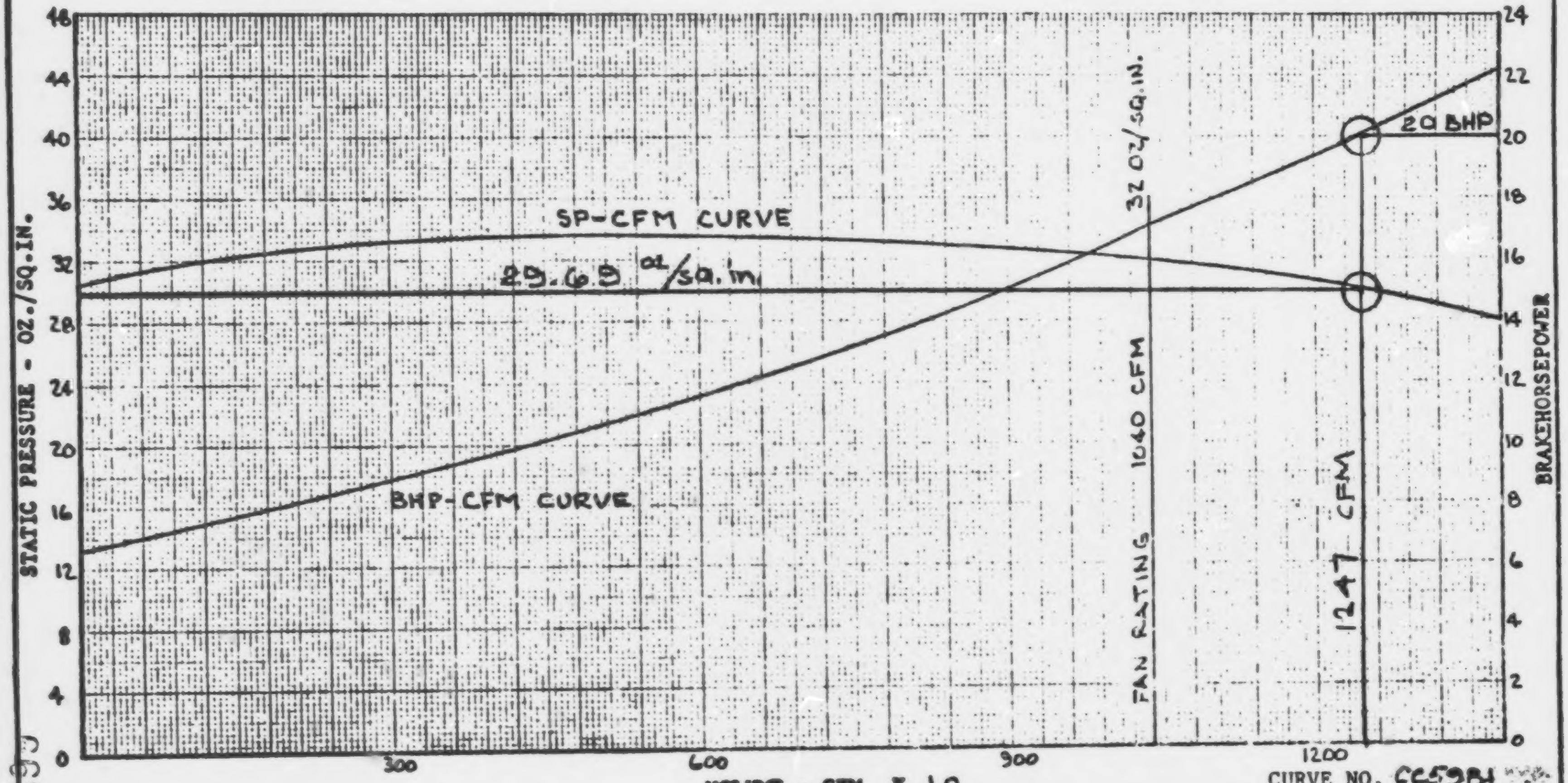
____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 2-1/2 **months**

SIZE: 2T-15-32	**TITLE:** DESIGN 55 ARRANGEMENT 8 TURBO PRESSURE BLOWER
	3500 RPM

NOTE: FANS ARE POINT - RATED



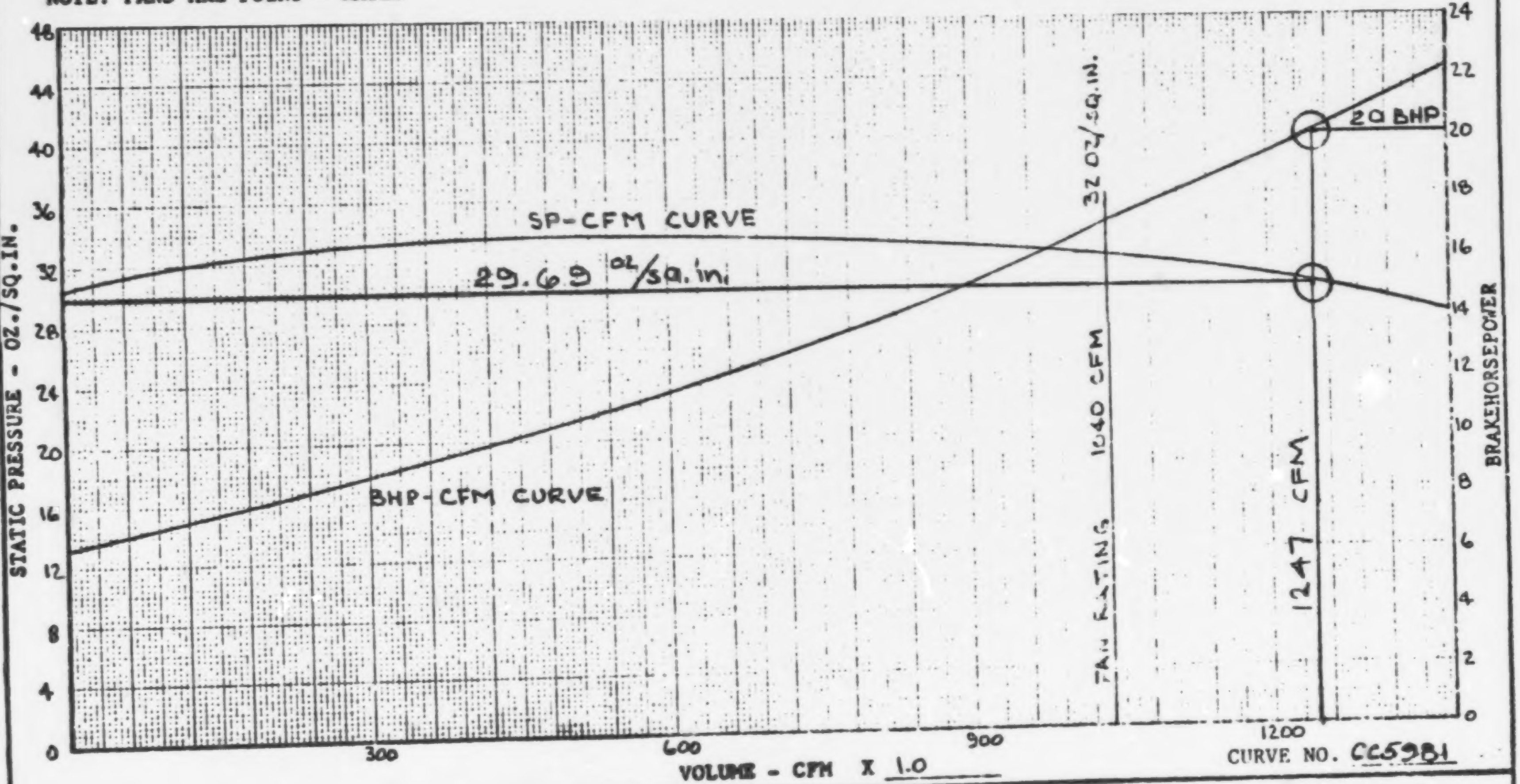
VOLUME - CFM X 1.0

CURVE NO. CC5981

CUSTOMER: Integ - Intercontinental Engineering Ltd.	901 REGENT AVENUE WEST, WINNIPEG, MANITOBA R2C 2Z8			
PROJECT: 0243	DRAWN mw	DATE Nov 8/83		CUST. P.O. NO.

SIZE: 2T-15-32	TITLE: DESIGN 55 ARRANGEMENT 8 TURBO PRESSURE BLOWER	
		3500 RPM

NOTE: FANS ARE POINT - RATED



CURVE NO. CC5981

901 REGENT AVENUE WEST,
WINNIPEG, MANITOBA R2C 2Z8

CUSTOMER: Integ - Intercontinental Engineering Ltd.

PROJECT: 0243

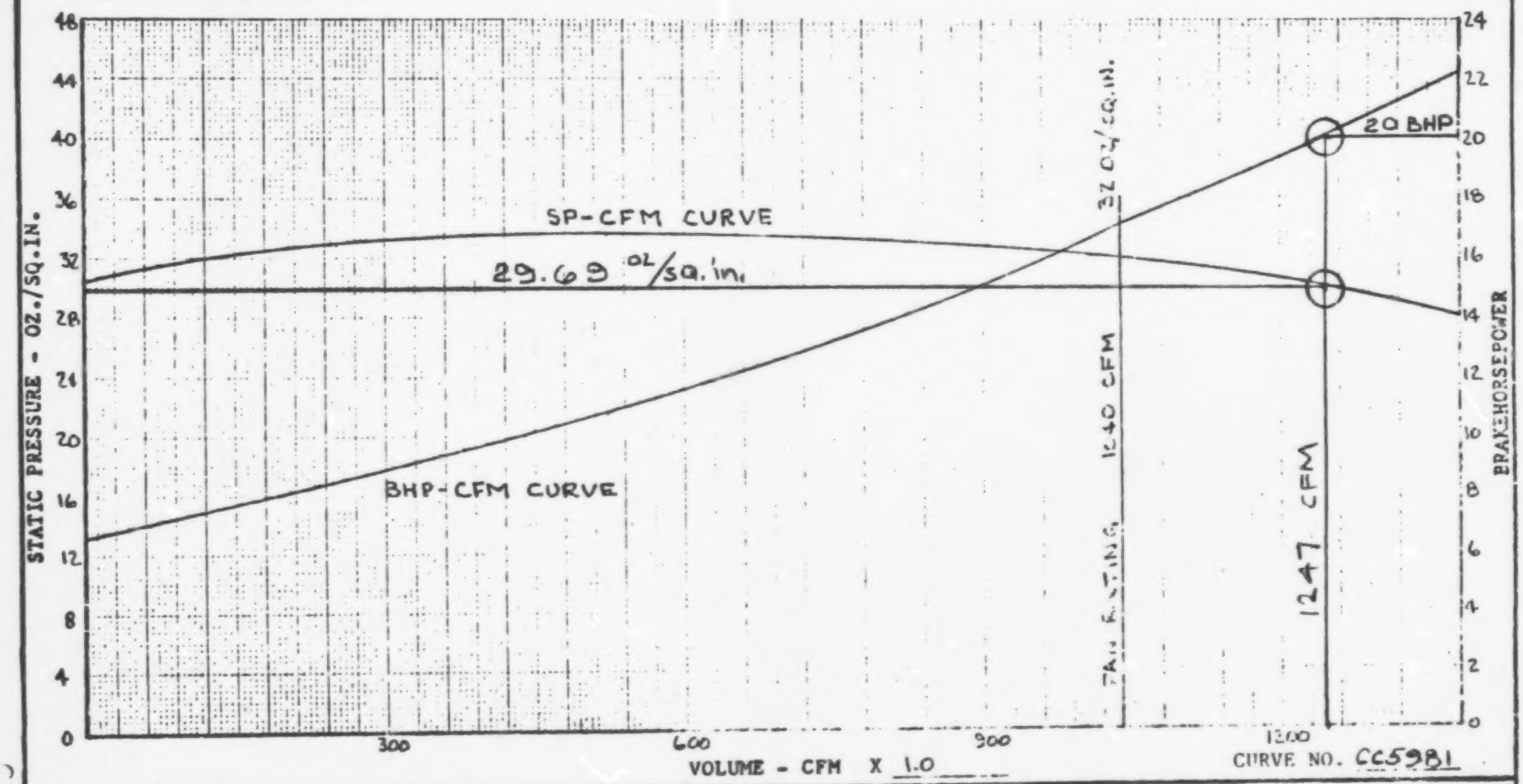
DRAWN	DATE		CUST. P.O. NO.
mw	Nov 8/83		

SIZE: 2T-15-32

TITLE: DESIGN 55 ARRANGEMENT 8 TURBO PRESSURE BLOWER

3500 RPM

NOTE: FANS ARE POINT - RATED



CURVE NO. CC5981

CUSTOMER: Integ - Intercontinental Engineering Ltd

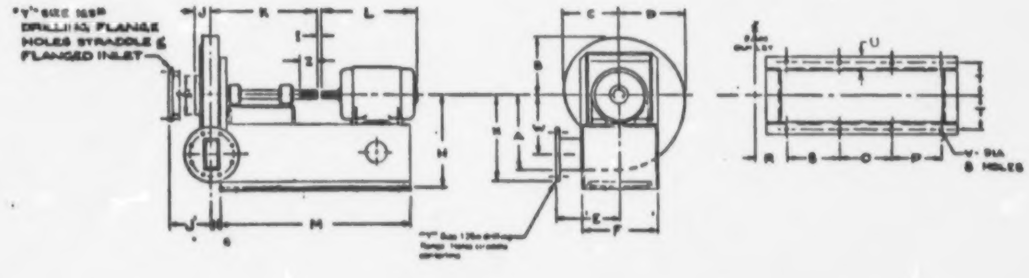
PROJECT: 0243

901 REGENT AVENUE WEST.
WINNIPEG, MANITOBA R2C 2Z8

DRAWN mw

DATE Nov 8/83

CUST. P.O. NO.


"Y" SIZE 125# DRILLING FLANGE HOLES STRADDLE ℄ FLANGED INLET
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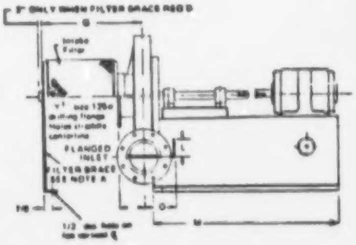
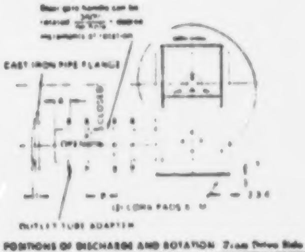
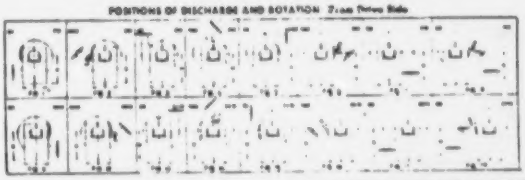
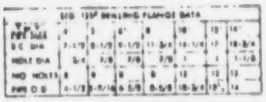

2" ONLY WHEN FILTER BRACE REQ'D
G
FLANGED INLET
FILTER BRACE SEE NOTE A
N
M


CAST IRON PIPE FLANGE
OUTLET TUBE ADAPTER

POSITIONS OF DISCHARGE AND ROTATION From Drive Side





FAN SIZE	SHAFT DIA	KEYWAY	A	B	C	D	E	F	G	H	I	J	J'	K	L	M	N	INTAKE FILTER Q	MODEL	O	P	R	S	T	U	V	W	X	Y	Y'	Z
2T 15 32	1 11/16	3/8 × 3/16	20 3/4	27 7/16	20 7/8	24 21/32	23 1/8	20	13 1/4	34	1/8	–	5 9/16	28	23 7/16	48	1 5/16	—	—	13	4	[illegible]	6	3 7/8	2 3/4	5/16	22"	32"A	[illegible]	10	4'

ITEM NO.	NO REQD	IDENTIFICATION	FAN SIZE	FIG. NO.	PERFORMANCE KPag	AM³/S	R.P.M.	KW	DENSITY	MOTOR DATA H.P.	R.P.M.	CURRENT	FRAME	TYPE	SPECIAL FEATURES
	1		2T-15-32	13	8.7	0.586	3540	10.15	0.803 kg/m³	20	3600		256T	TEFC	

SPECIAL FEATURES

1. INTAKE FILTER (INCLUDES FILTER BRACE)
2. SHAFT SEAL: (A) FELT - (B) ASBESTOS
3. OUTLET TUBE ADAPTER - Y SIZE PIPE
4. INLET TUBE ADAPTER (SAME AS FLANGED INLET BUT LESS DRILLING FLANGE) Y' SIZE PIPE.
5. RUBBER CONNECTOR - 6 INCHES LONG WITH CLAMPS: (A) OUTLET - (B) INLET
6. FLANGED INLET
7. CAST IRON PIPE FLANGE: (A) OUTLET; Y SIZE PIPE - (B) INLET; Y' SIZE PIPE.
8. BLAST GATE: (A) OUTLET; Y SIZE PIPE - (B) INLET; Y' SIZE PIPE.
9. CORK PADS
10. DISCHARGE ELBOW 90° - REQUIRED FOR ALL FANS MARKED WITH AN ASTERISK WHEN 2G UNIT IS REQUIRED - FAN FURNISHED TAD. SEE DWG.
11. STEEL WHEEL

NOTES

NOT CERTIFIED
FOR SALES PURPOSES ONLY
DO NOT USE FOR CONSTRUCTION

CUSTOMER INTEG - INTERCONTINENTAL ENG. LTD
P.O. #
JOB NAME
LOCATION
ARCH./ENGINEER , CITY

TURBO PRESSURE BLOWERS - ARRANGEMENT 8
FIXED HOUSINGS

NORTHERN BLOWER
901 REGENT AVE WEST, WINNIPEG 25, MANITOBA
AREA CODE 204/222-4216

FURNISHED FOR SALES PURPOSES-DIMENSIONS NOT CERTIFIED BY CML	DATE 82/11/10	SUBMITTED BY DCT	SALES OFFICE
DRAWING CERTIFIED BY CML - FURNISHED FOR APPROVAL - NOT RELEASED FOR PRODUCTION	DATE	DRAWN BY	JOB
DRAWING CERTIFIED BY CML - APPROVAL NOT REQUIRED - RELEASED FOR PRODUCTION	DATE	DRAWN BY	DWG # cu 3359

173-1

STACK

BIDDER'S LIST

STEEL STACK (171-2)

Luftek
P.O. Box 697
Shoreham, N.Y.
11786 USA

Attention: Mr. J. Carter

Francis Hankin & Co. Ltd.
117 Crockford Blvd.
Scarborough, Ont.
M1R 3B9

172-1

DIAMOND LUFTEK CONSTRUCTION, INC.
160 GREAT NECK ROAD
P.O. BOX 971
GREAT NECK, NEW YORK 11022

(516) 482-7770

14 November 1983

Re: Steel Stack Invitation
Inquiry No. 173-1
Account No. 0243-173

integ
NOV 2 1 1983
GRC
DATE
FILE

Integ
1155 West Pender St.
Vancouver, B.C.,
Canada V6E2P4

Attention: Mr. G.R. Cooper P. Eng.
Project Manager

Gentlemen:

Please find enclosed the subject proposal and do not hesitate to contact our representative or ourselves should you have any questions or need clarification.

Very truly yours,

DIAMOND LUFTEK CONSTRUCTION, INC.

John J. Carty P.E.

John J. Carty, P.E.

Enclosures

cc: Canada Diamond-Luftek
L. Gauthier

SCHEDULE I - SCHEDULE OF PRICES

STACK

1.	Steel stack as described in the specification, FOB point of sale	$ 14,760
2.	Canadian Customs Duty _____ % of $ __________	$ NA
3.	Transportation to site	$ 900
	TOTAL	$ 13,860 CANADIAN DOLLARS

SCHEDULE II - TECHNICAL DATA

STACK

1.0 SPECIFICATIONS

Manufacturer's Name	DIAMOND-LUFTEL
Vendors Name	DIAMOND-LUFTEL
Outer shell diameter	559 mm
Outer shell thickness	5 mm
Outer shell material	ASTM A242 STEEL
Inner shell diameter	305 mm
Inner shell thickness	5 mm
Inner shell material	ASTM A242 STEEL
Insulation type	JM, FIBERGLASS
Insulation thickness	76.2 mm
Roof collar diameter	711 mm
Anchor bolt diameter	25.4 mm
Guy wire material and size	GALV. WIRE - 6 mm ϕ
Access cleanout door size	152 mm
Stack weight	1400 kg
Section length (as shipped)	12.62 m
Required roof opening	711 mm

2.0 LIST OF ALTERNATIVES OR DEVIATIONS

____

____

____

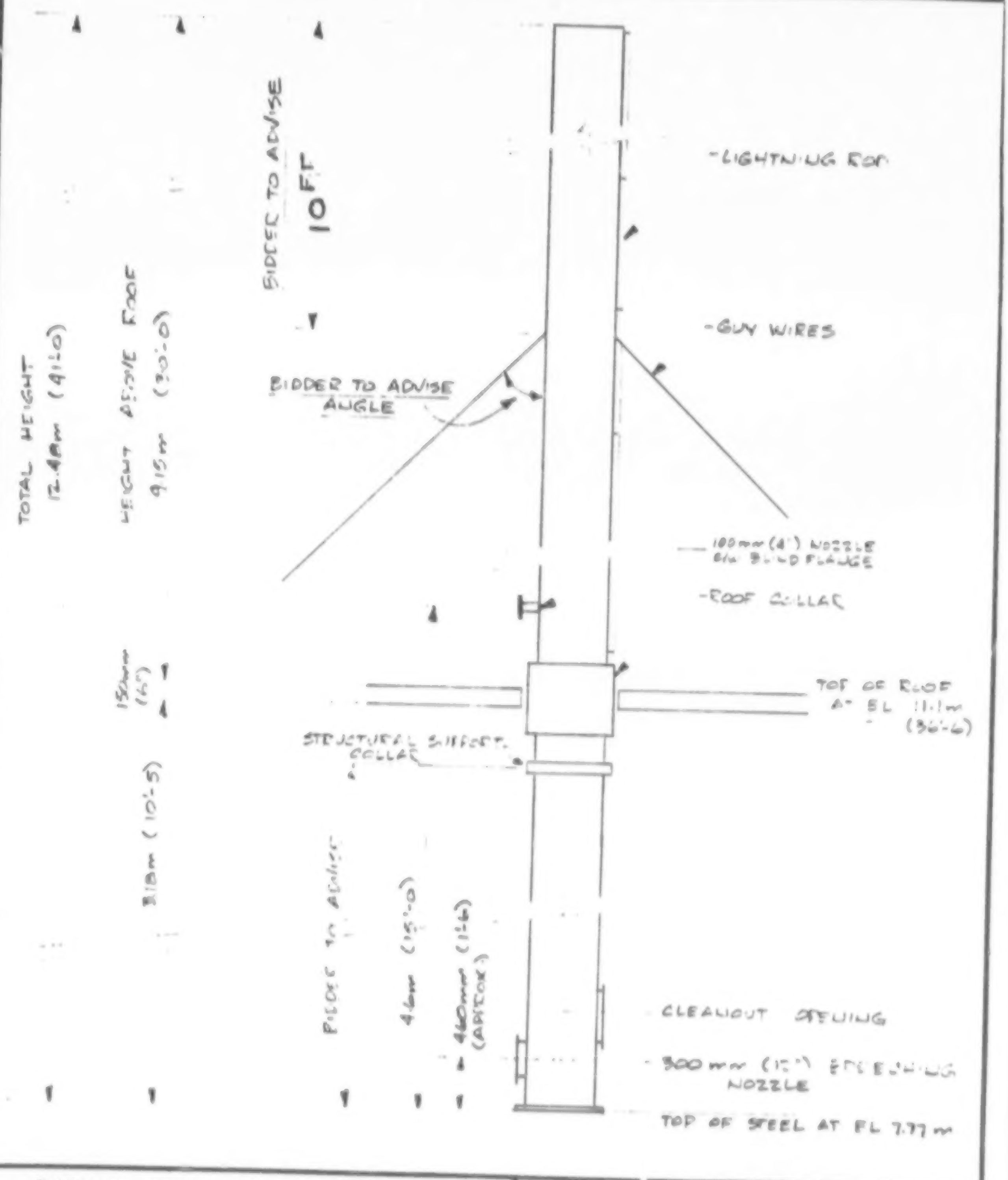
____

____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____2____ months

C78


TOTAL HEIGHT 12.48m (41'-0)
HEIGHT ABOVE ROOF 9.15m (30'-0)
BIDDER TO ADVISE 10FT
BIDDER TO ADVISE ANGLE
-LIGHTNING ROD
-GUY WIRES
100mm (4") NOZZLE c/w BLIND FLANGE
-ROOF COLLAR
150mm (6")
TOP OF ROOF AT EL 11.1m (36'-6)
STRUCTURAL SUPPORT COLLAR
3.18m (10'-5)
BIDDER TO ADVISE
4.6m (15'-0)
460mm (1'-6) (APPROX)
CLEANOUT OPENING
300mm (12") BREECHING NOZZLE
TOP OF STEEL AT EL 7.77m

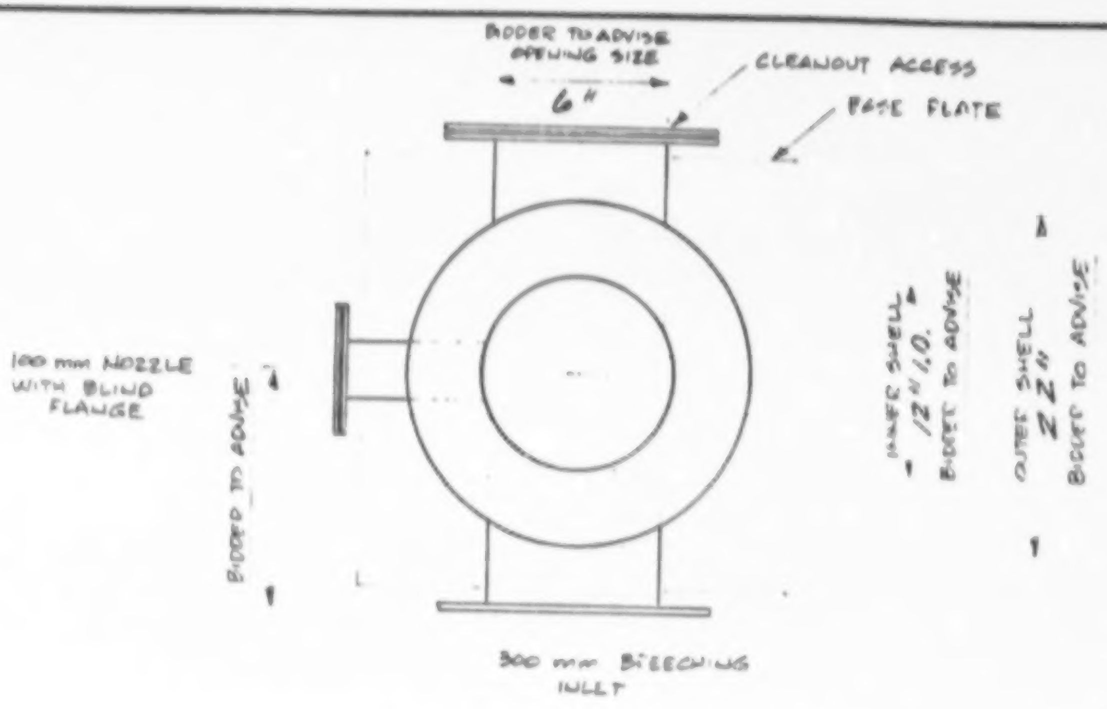
ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

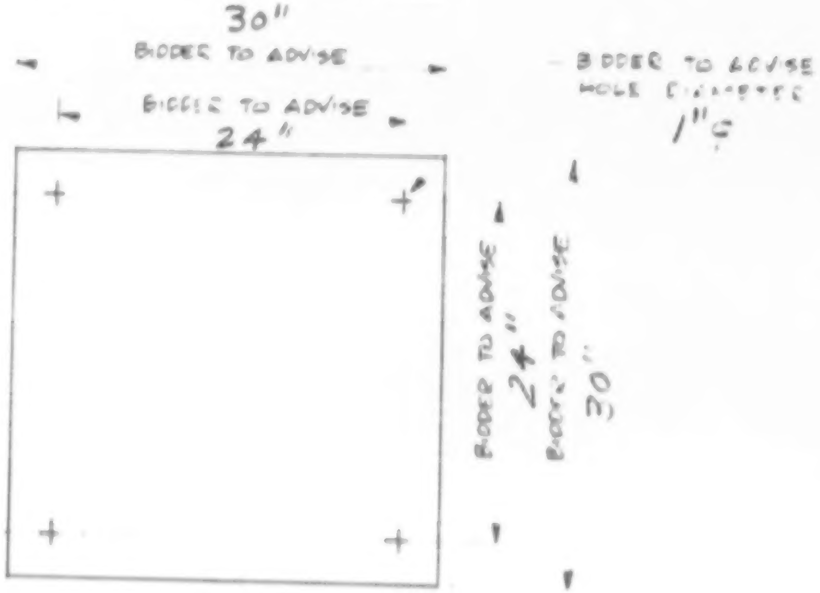
integ
Intercontinental Engineering Ltd

SCALE		DATE	
DRAWN		AUG 30/85	STACK · ELEVATION
CHECK			SHEET 1
APP'D.			

A	0243	SK	175-1	0


BIDDER TO ADVISE OPENING SIZE
6"
CLEANOUT ACCESS
BASE PLATE
100 mm NOZZLE WITH BLIND FLANGE
BIDDER TO ADVISE
INNER SHELL 12" I.D. BIDDER TO ADVISE
OUTER SHELL 22" BIDDER TO ADVISE
300 mm BREECHING INLET

SECTIONAL VIEW OF STACK


30"
BIDDER TO ADVISE
BIDDER TO ADVISE
24"
BIDDER TO ADVISE HOLE DIAMETER
1"⌀
BIDDER TO ADVISE
24"
BIDDER TO ADVISE
30"

STACK BASE PLATE

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE		DATE	
DRAWN			
CHECK			
APP'D.			

STACK · DETAILS

SHEET [illegible]

A	0243	SK	[illegible]	[illegible]

211-1
FUEL STORAGE AND METERING SYSTEM

211-1

BIDDER'S LIST

FUEL HANDLING SYSTEM (211-1)

F. Drexel Western Ltd.
4084 McConnell Court
Burnaby, B.C.
V5A 3N7

Attention: Mr. Ray Mathieson

Merrick Canada Ltd.
494 The Queensway
Peterborough, Ontario
K9J 7L9

Attention: Mr. D.E. Lewis, P. Eng.

J & M Industrial Supply Ltd.
2899 Steeles Ave. W., Unit No. 4
Downsview, Ont.
M3J 9Z9

Attention: Mr. D. Robertson

Armstrong Jones Ltd.
83 Sunrise Ave.
Toronto, Ont.
M4A 1B1

F. DREXEL WESTERN LTD.

☒ **BURNABY, B.C.** V5A 3N7
4084 McCONNELL COURT.
PHONE (604) 420-2443 TELEX 04-354852

☐ **PRINCE GEORGE, B.C.** V2N 1X5
1846 QUINN STREET
PHONE (604) 563-0179 TELEX 047-8612

☐ **EDMONTON, ALBERTA** T5B 4J7
6720 SANTA ROSA RD.
PHONE (403) 471-4301 TELEX 037-2629

☐

drexel

211-1

(BROCHURE INCL.)

TO
Intercontinental Engineering Ltd.,
7th Floor, 1155 West Pender Street
VANCOUVER, B.C.
V6E 2P6

PAGE 2

ATTENTION: Grant Cooper
REFERENCE: Project 0243, Inquiry No. 221-1
QUOTATION NO: #W49138
DATE: November 28th, 1983

ITEM	QUANTITY	SIZE	DESCRIPTION	UNIT PRICE
2.	1		FUEL METERING SYSTEM (all fuels except fluid coke)	
			K-TRON LWF-500 LOSS-IN-WEIGHT metering system, complete as follows:	$ 58,158.00
			S-500 screw type agitated feeder with 150 mm open-flight screw	
			15 ft.^{3} (0.43 m^3) closed-top hopper	
			Digital controller as item 1	
			Remote controls as item 1	
			Automatic hopper inlet slide gate	
			Outlet sampling and diverter valve	
			Outlet manual slide gate valve	
			4-20 mA output signal proportional to mass flow	
			Intrinsically safe controls (suitable for Class II Division I, Group F hazardous areas)	
3.			FEEDER FOR FLUID COKE	
			The feeder used for the other fuels will not be suitable for fluid coke, due to its high floodability, When fluid coke is being fed, we propose that the S-500 screw feeder be replaced with a T-35 twin-screw feeder. The rest of the feeder system remains unchanged.	
	1		K-TRON T-35 twin-screw feeder	$ 10,600.00
			....../3	

Calgary-Edmonton-Lethbridge-Prince George-Regina-Saskatoon-Vancouver-Victoria

F.O.B. POINT: as per attached
DELIVERY: as per attached
TERMS: NET 30 DAYS
ALL TAXES EXTRA

APPROVED BY: Mike Patti

PREPARED BY: Ray Mathieson

F. DREXEL WESTERN LTD.

☒ **BURNABY, B.C. V5A 3N7**
4084 McCONNELL COURT.
PHONE (604) 420-2443 TELEX 04-354852

☐ **PRINCE GEORGE, B.C. V2N 1X5**
1846 QUINN STREET
PHONE (604) 563-0179 TELEX 047-8812

☐ **EDMONTON, ALBERTA T5B 4J7**
6720 SANTA ROSA RD.
PHONE (403) 471-4301 TELEX 037-2629

☐

TO

Intercontinental Engineering Ltd.,
7th Floor, 1155 West Pender Street
VANCOUVER, B.C.
V6E 2P6

PAGE 3

ATTENTION: Grant Cooper
REFERENCE: Project 0243, Inquiry No. 221-1
QUOTATION NO: #W49138

DATE: November 28th, 1983

ITEM	QUANTITY	SIZE	DESCRIPTION	UNIT PRICE
			NOTES: 1) We have proposed screw-type loss-in-weight systems, rather than the gravimetric belt-types specified, for the following reasons: - the system can be vented downstream of the feeder screw, so that back-pressure would not reach the feeder itself. - the automatic hopper loading should allow a simpler system - for example, the limestone feeder hopper could be loaded directly from the loading system cyclone, thereby eliminating the storage bin. 2) The proposed equipment is described in the attached data sheets. 3) Since the equipment proposed is not to your specifications, we have not completed your data sheets. We are however always available to provide any information you may need.	

Calgary-Edmonton-Lethbridge-Prince George-Regina-Saskatoon-Vancouver-Victoria

F.O.B. POINT: Our Burnaby, Warehouse
DELIVERY: 14-16 weeks
TERMS: NET 30 DAYS
ALL TAXES EXTRA

APPROVED BY: Mike Patti

PREPAREC BY: Ray Mathieson

Z11-1
(BROCHURES INCL.)

MERRICK

Merrick Canada Ltd.
494 The Queensway
Peterborough, Ontario
Canada K9J7L9
(705) 742-9233

November 17th, 1983

INTEG - International Engineering Limited
1155 West Pender Street
VANCOUVER, B.C.
V6E 2P4

Attention: G.R. Cooper, P. Eng.
Project Manager

Reference: Energy Mines and Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Equipment Cost Estimate
INTEG File 0243-E1
Merrick Proposal A-34307

Gentlemen:

With reference to your recent request for Quotations of October 21st and our subsequent meeting at your offices on Tuesday, November 8th, we thank you for this opportunity to recommend our Merrick Material Handling and Feeding Systems for Fuel and Limestone and to offer our detailed Proposal A-34307 for your consideration.

In accordance with our discussions, in lieu of designing the Systems for to handle 52 kPag pressure, we are proposing a Rotary Airlock Feeder at the discharge of each Merrick Weighfeeder. The Rotary Airlock is designed to isolate up to 103 kPag of downstream pressure and to serve as a back-up to your Proposal Rotary Airlock at the Screw Conveyor discharge, which will act as the primary sealing component against combustor back pressure.

On the Limestone Handling System as specified, in accordance with good engineering design, we propose to provide the Gravimerik Weighfeeder with a Constant Speed A.C. Drive and close the control loop for the feeding system with a variable speed DC Drive on a Merrick Model MCF-1900 Screw Prefeeder.

..... 2

The Screw Prefeeder will be suitably sized and designed to ensure a constant delivery of limestone to the Weigh Belt while preventing possible flooding of material in a fluid state.

At the other end of the spectrum of material handling characteristics for Limestone, if this material will be held in the storage bin for long periods of time and during which deaeration would occur and result in briding, we would recommend use of a Vibrating Bin Discharger to ensure successful, continuous material withdrawal.

Pertaining to the fuel handling system, the local control console we are proposing for the Weighfeeder, in suitable Explosion Proof Enclosure, will be provided with the functions specified and will be entirely suitable for purposes of calibration with actual fuel materials or adjusting the weighfeeder setpoint. However, we have assumed that for normal operation, the digital Setpoint Selection in the Panel Mounted DSC Controller will be operative.

Our preliminary system layout calculations indicate that the equipment can be installed within the dimensional restraints shown on your drawings.

Prices are furnished in Canadian Funds, F.O.B. Peterborough, Ontario with Estimated Freight to Ottawa shown separately. Any taxes applicable would be extra; Terms net 30 Days.

Delivery of equipment would be nine (9) to eleven (11) weeks after release toproduction with drawing approval. Drawings for approval would be furnished three (3) to five (5) weeks after receipt of a valued Purchase Order.

Descriptive literature with dimensional information is enclosed for your use, to-gether with typical mechanical and electrical drawings and the requested arrangement drawing from our Engineering Department.

Trusting our Proposal is sufficiently detailed for your requirements, we look forward to working further with you on this Project.

Yours very truly
MERRICK CANADA LTD.

David E. Lewis

David E. Lewis, P. Eng.
Project Engineer

cc: T. Miskovich - Roseland
Enc;

MERRICK

Merrick Canada Ltd.
494 The Queensway
Peterborough, Ontario
Canada K9J 7L9
(705) 742-9233
Telex 06-962921

Proposal

To: INTEG - International Engineering Limited
1155 West Pender Street
VANCOUVER, B.C. Canada
V6E 2P4
Attn: Mr.G.R. Cooper, P. Eng.- Project Manager

Date: November 17, 1983
Your ref: File 0243-E1
Proposal No.: A-34307

Item No.	Quantity	Description	Price
		GENTLEMEN:	

WE PROPOSE TO FURNISH THE FOLLOWING EQUIPMENT, F.O.B. PETERBOROUGH, ONTARIO WITH FREIGHT ALLOWED TO OTTAWA, ONTARIO, IN CANADIAN FUNDS, EXCLUSIVE OF ALL APPLICABLE TAXES, IN ACCORDANCE WITH MERRICK TERMS AND CONDITIONS INCORPORATED HEREWITH.

FUEL STORAGE AND METERING SYSTEM

Item No.	Quantity	Description
1:0	1	20" MERRICK MODEL 950 DSC-1 WEIGHFEEDER Engineered and Designed to the following requirements:

Material:	Coke:	Coal:	Wood:	Peat:
Capacity:	0.083	0.083	0.083	0.083 Kg/S
Density:	800	960	160	170 Kg/M3
Size:	-100 Mesh	-3.04mm	-10.64mm	-100 mesh
Moisture:	Dry	7.0%	Dry	Dry
Temperature:	Ambient Indoors			
Drive:	SCR DC			
Prefeeder:	Bin Discharger			
Power Required:	115 VAC/1/60			

STANDARD EQUIPMENT:

A. Self-Contained Belt Feeder, Including:

1. Cantilever CRS Feeder frame designed to permit quick replacement of feeder belt and complete removal of the feeder for maintenance. Frame is supported by 304 SS support rods.
2. Crowned aluminum conveyor head and tail pulleys.
3. Belt - precision woven endless, polyester, black neoprene coated, rated at 250°F (120°C).
4. 304 SS slider bed support decks.

This proposal is subject to all terms and conditions printed on reverse side

Form No. 142-C

Item No.	Quantity	Description	Price
		5. 304 SS full length skirtboards designed for quick removal. 6. 304 SS infeed with insert (square) 7. 304 SS shear gate - manually adjusted. 8. 304 SS feed cutoff gate (manual slide gate valve) 9. 304 SS metal blade scrapers at belt discharge, inside belt and tail pulley. B. Weight Transducer System, Including: 1. Precision milled aluminum weighdeck. 2. Precision strain gauge load cell with overload protection. Designed to meet Class II, Division I, Groups E,F and G. C. Speed Pickup: Model 950 - MSP-1 Solid State Speed Pick-Up, driven off drive motor D. Motor: Model 950 - 1/4 H.P. XPF DC Motor labelled for Class II, Division I, Groups E,F and G, directly coupled to head pulley, including suitable reducer, right angle drive, couplings, guards, and FSC-4C motor speed controller (SCR) mounted in separate NEMA 12 enclosure out of hazardous area. E. Test Chain - for calibration F. DSC-1 Digital Feed Control System (S/S 850) 1. 4 digit thumbwheel switch for setting rate. 2. "High" and "low" alarm contacts and lights. 3. Proportional band and reset adjustment.	

Item No.	Quantity	Description	Price
		4. 0-5 MA DC controller correction output signal.	
		5. 4 digit L.E.D. digital "rate", "weight" and "speed" display.	
		6. 8 digit L.E.D. totalizer - resettable.	
		7. Analog "rate" output signal.	
		8. Digital output signals.	
		9. Remote 4-20 mA Demand Signal Input Port.	
		10. Panel mount or wall mount enclosure.	
		11. Taylor Barrier Strip #1135FF21000 mounted out of hazardous area, designed to meet Class II, Division I, Groups E,F and G.	
		G. EQUIPMENT SUPPLIED BY OTHERS:	
		1. "Start-stop" pushbuttons for panel mounted DSC-1 Controller.	
		2. "Power" disconnects.	
		3. Supports other than specified.	
		4. Wiring between remote and local instruments.	
		5. Stepdown transformers or isolation converters.	
		H. SPECIAL EQUIPMENT:	
		1. Standard Enclosure with easy clean cantilevered stringer assembly, 304 SS construction, except carbon steel door and enamel exterior (Merrick blue-green). Includes removeable side door with full length clear plastic window and quick removal handles.	
		2. Sampling Chute Carbon Steel Construction with manually operated gate.	
		3. Local Control Station, in EEMAC 9 Enclosure, includes: a) Hand-off-Auto Selector Switch. b) Start and Stop Buttons. c) 3-1/2 digit L.E.D. digital "rate" display. c) Potentiometer Set Point Selector.	

Item No.	Quantity	Description	Price
		ACCURACY: The Model 950 DSC GRAVIMERIK is guaranteed to feed with an accuracy of plus or minus 0.5% of set rate up to 20:1 range, at 2 sigma, based on a minimum sample of one (1) minute or the time equivalent to two (2) circuits of the belt, whichever is greater. NOTE: 2 sigma means that 95% of all tests performed will be within the accuracy guarantee. Merrick has achieved better results with most of the materials tested in our laboratory, but our accuracy statement is based on unknown materials and should be considered as a general rather than a specific statement of accuracy. Material tests must be performed to confirm what accuracy can be achieved. Sigma is the square root of the sum of the mean-squared deviations from the mean divided by the number of samples taken. Experience has proven that the longer the sampling time and the larger the number of tests, the more accurate the results are.	
2:0	1	48" VIBRANETICS MODEL BD-4 BIN DISCHARGER Designed and Engineered to the following Specifications: A. Shell 1/8" thick Mild Steel, 48" inlet diameter, 12" outlet diameter, 45 degree slope, Special 60 degree Internal Steep Cone. B. Drive 2.0 H.P., Explosion Proof, 575 Volts, 1 Phase, 60 Hz. C. Cycle Timer, Solid State, Multi Cycle will be provided. D. Isolation: Unit will be supplied with Vibranetics forged Steel Hanger Arms with rubber isolators for support from above. E. Stroke and Frequency: 1/8" @ 1750 CPM	

Item No.	Quantity	Description	Price
		F. Flexible Seals - Inlet Sock and Skirt (Superseal) and outlet sock will be provided with the unit constructed of Black EDPM material with 304 SS drawbands. G. FINISH (INSIDE) - Welds Cleaned, No Paint FINISH (OUTSIDE)- Standard Sandblast and Enamel Paint H. Inspection and Assembly - Unit will be completely shop assembled and inspected prior to shipment.	
3:0	1	MERRICK STORAGE HOPPER, Designed and Engineered to the following Specifications: A. Storage Capacity of 110 Cu. Ft. B. Constructed of 3/16" Thick Mild Steel, 5'0" diameter Flanged Inlet x 5'0" Straight Side Height with 60 degree Lower Conical Section to 4'0" Outlet Opening. C. Half-Coupling Fittings for High and Low Level Indicators. D. Flanged sampling port, 2" diameter, complete with Mild Steel, Manual Slide Gate Valve. E. Bin Cover, Mild Steel Construction, 3/16" Thick with following features: 1. Main Fuel Inlet, 11" square, Flanged, complete with Manual Mild Steel Slide Gate Valve. 2. Auxilliary Fuel Inlet/Inspection Port, 12" diameter, Flanged, complete with Cover w/Handle and two (2) Quick Clamp Fasteners.	

022

Item No.	Quantity	Description	Price
		3. Filter Vent, 5" diameter, c/w Mild Steel Manual Slide Gate Valve and Filter Sock and Cage with Stainless Steel Clamp.	
		F. Four (4) Integral Support Legs, 3" x 3" Angle, stitch welded to Bin Body with Bottom Plate Flanges, drilled for Anchor Bolts (By Others)	
4:0	2	LEVEL INDICATORS, EQUAL TO MONITOR, Bin Level Switch, SPDT, Paddle-Type, Required 115/1/60 Power Supply	
5:0	1	ROTARY AIRLOCK FEEDER, MODEL VB8 x 8 Designed and Engineered to the following Specifications:	
		A. Cast Iron End Plates, Steel Rotor and Body.	
		B. Precision machined.	
		C. Drop through Design.	
		D. 8 inch Square Inlet and Outlet.	
		E. Inboard Bearings and Double Lip Seals.	
		F. 1 H.P. A.C. Gear Motor Drive complete with Chain Drive and Guard.	
		TOTAL PRICE ONE (1) FUEL STORAGE AND FEEDING SYSTEM, COMPLETE AS DESCRIBED - ITEMS 1 THROUGH 5	$36,096.00

SCHEDULE I - SCHEDULE OF PRICES

FUEL HANDLING SYSTEM

1.	One (1) fuel handling system as described in the specification, FOB point of sale	$ 36,096.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ 600.00
	TOTAL	$ 36,696.00

SCHEDULE II - TECHNICAL DATA

FUEL HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name	The Merrick Corporation	
Vendor's Name	Merrick Canada Limited	
Bin Discharger Model and Type	Vibranetics Model BD-4	
Weighfeeder Model and Type	Merrick Model 950CF	
System total dimensions as package	1500 x 1820 x 3800	**mm**
Unit total weight as package	1400	**kg**
Bin height	1500	**mm**
Bin diameter	1500	**mm**
Discharger diameter	305	**mm**
Discharger exciter type	B-Belt Drive	
Discharger flows		
- **Minimum w/coal rejects**	0.008	**kg/s**
- **Maximum w/coal rejects**	0.950	**kg/s**
- **Minimum w/wood chips**	0.008	**kg/s**
- **Maximum w/wood chips**	0.020	**kg/s**
Weighfeeder belt width	610	**mm**
Weighfeeder flows		
- **Minimum w/coal rejects**	0.0048	**kg/s**
- **Maximum w/coal rejects**	0.095	**kg/s**
- **Minimum w/wood chips**	.0001	**kg/s**
- **Maximum w/wood chips**	.0020	**kg/s**

Weighfeeder outlet connection dimensions 228 x 559 mm

Discharger motor

- **Enclosure type** XPF
- **Manufacturer** Westinghouse
- **Model**
- **Temperature rise** 40 °C
- **Power output** 1.5 kW
- **Frame size** 146T
- **Speed** 1750 rpm

Weighfeeder drive

- **Type** DC
- **Manufacturer** Merrick
- **Model** DSC-1
- **Speed ratio** 20:1
- **Power rating** 0.20 kW
- **Power supply requirements** 575 VA 3 V 60 phase

Weighfeeder motor

- **Enclosure type** XPF
- **Manufacturer** GE or equal
- **Power output** 0.2 kW
- **Temperature rise** 40 °C
- **Speed** 1750 rpm
- **Frame size** 56C

Control power requirements

- **Weighfeeder** 575 VA 3 V 60 phase

2.0 LIST OF ALTERNATIVES AND EXTRAS

Rotary Airlock Feeder

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 4 months

MERRICK SCALE MFG. CO. OF CANADA Ltd/Ltee

DATE: November 17/83
PROPOSAL: A-34307

DOMESTIC SERVICE RATES, TERMS AND CONDITIONS

Field Service Representatives are available for erection supervision, system start-up and normal maintenance service from Peterborough, Ontario or our authorized representative.

EQUIPMENT INSTALLATION & ERECTION

Since Merrick Scale Mfg. Co. of Canada Ltd. does not maintain installation or erection crews, all equipment installation is to be completed by Purchaser in accordance with Merrick approved drawings and instruction manuals.

SERVICE REQUEST LEAD TIME

Domestic start-up and maintenance service requests require a TWO WEEK MINIMUM NOTIFICATION to the Service Department to insure confirmation of service date requirements.

PURCHASE ORDERS

Service requests may only be scheduled after receipt of a purchase order from the buyer authorizing service. Start-up service authorization not included in the original equipment Purchase Order will be scheduled upon receipt of a purchase order authorizing this service. Service charges will be billed in accordance with the service rates terms and conditions in effect at the time the service Purchase Order is received.

RATE

$340. per 8 hour day or portion thereof, portal to portal from the nearest Merrick service base, if possible, plus travel and living expenses. A minimum service charge of 8 hours plus expenses will apply Monday thru Friday for time service representatives must remain at the job site area but unable to work because of plant production or work schedules.

PREMIUM RATE

Time and one half will apply for all hours worked beyond the 8 hours per day basis and for all work done on Saturdays. Double time will apply for all Sunday or Holiday work. This includes any travel necessary on a Sunday or Holiday to meet service requirements on a Monday or the day following a Holiday.

LAYOVER CHARGES

Living expenses will be charged during the time a man must remain in the jobsite area over a weekend and not able to work because of plant production or work schedules.

TRAVEL EXPENSE

Travel expense is actual cost of transportation to jobsite, local transportation and return to service base by air, rail, ship, bus or rented car. Mileage for transportation in Merrick Vehicles along with tolls for highways, bridges, tunnels and ferries will be charged when applicable.

LIVING EXPENSE

Living expenses includes expenditures for lodging, meals, tips, laundry and all wires or telephone calls connected with the job.

TRAVEL TIME

Travel time is the time expended traveling to the jobsite, local travel, and returning to the service base utilizing any of the means of transportation listed under travel expense.

TERMS OF PAYMENT

Net cash, upon presentation of invoice, since charges cover labor, travel and living expenses. A copy of the service report will accompany the invoice. Additional reports when required will be furnished upon request.

PARTS REPLACEMENT BY SERVICE REPRESENTATIVE

Defective parts under warranty will be replaced in accordance with the warranty policy as shown in our Standard Terms and Conditions of Sale Form 101. Service for replacement of these parts will be charged at the normal rate. Parts replaced due to normal wear and not under warranty will be charged on service invoice.

INSURANCE

Insurance certificates will be furnished upon request covering Workman's Compensation, Comprehensive General Liability, Automobile Liability, and Contractual Liability. Buyer shall indemnify, exonerate, hold harmless and defend Merrick Scale Mfg. Co. of Canada Ltd. from and against any actions or suits and any claims, liability damage, loss, cost or expense as a result of bodily injury or death and/or property damage arising out of or in connection with performance of services.

ORDER ACKNOWLEDGEMENT

Verbal or written purchase order acknowledgement for service shall constitute a contract embodying all and only the terms stated herein. Additional terms proposed by the Buyer are rejected unless expressly consented to in writing by Merrick Scale Mfg. Company of Canada Ltd.

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SIGNED: ______________________________

FORM 146-9C 2-81

211-1

J&M

J&M INDUSTRIAL SUPPLY LIMITED

2899 STEELES AVE. W., UNIT 4
DOWNSVIEW, ONTARIO M3J 3A1
TEL: (416) 665-2300 TELEX: 06-217758

(BROCHURES INCL.)

Date	Dec. 21/83
Quotation No.	83-03-11-2073
Your Inquiry No.	211-1
Reference:	Fuel Storage and Feeding System.

PROPOSAL TO:
Intercontinental Engineering Ltd.,
Attn.: Mr. G. R. Cooper, P. Eng.,
Project Manager,
1155 West Pender St.,
Vancouver, B.C.
V6E 2P4

EM .O.	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Dear Gentlemen: We thank you for your letter dated Oct. 21/83 and are pleased to submit our estimating quotation as follows:		
1.	1	Wallace & Tiernan Model 31-160 MC Manual Vertical Gate Feed Control Digital Weighbelt Feeder all as detailed in attached Catalogue file 310.160 and dwgs. 311.415 and 312.270. Feeder to be painted green and supplied complete with Digital Controll[illegible] (mounted on inlet end of feeder), single speed gear box, SCR drive, test weight, 316 s.s. side rails, coupling guard, standard belt, 4 rubber shock mounts, 1 gal. of oil, 6 sets of instructions, 4-20mA input capability, inlet flexible connection, outlet sample valve and air purge fitting. Feeder to be factory mutual approved for Class II, divisons 1 & 2, groups E,F & G areas.		
2.	1	Remote controls suitable for mounting in purchase's control panel complete with Digital Mass Flow Indicator, start/stop switch with run light and over/under feed alarm indicators.		
3.	1	Fabricated steel storage bin of 10 ga. (.1345 thk.) carbon steel construction, approx. 5 ft. max diam. with 2 ft. straight section, flanged bottom, close top, four 4" angle iron support legs with foot pads to foundation level, wire brushed inside and out and finished outside with shop primer. Unit shall be of all welded steel construction and shall be complete with; air purge fitting, 11" flanged inlet, 12" diam. flanged inspection port with gasket, hinged cover and hold down latch, 2" dia. sampling port, two openings for level controls, one 3" dia. flanged exhaust port.		
4.	1	Storage bin accessories including: two Model RXA-1 class II, div. I, group F rotating paddel type level indicators,		

Terms: Net 30 days, Taxes Extra. Prices Firm for 30 Days.

F

Delivery: weeks from receipt of written purchase order, approved drawings (if required), and all engineering details.

NOTES:
- Manufacturers' Standard Warranty Only Applies.
- 1 Set Instructions included; additional available at current price.
- Start-Up Service not included but available if required, at current service rates plus mileage and expenses.

J & M INDUSTRIAL SUPPLY LIMITED

Continued on page 2

PROPOSAL TO: Intercontinental Engineering Ltd.,
Attn.: Mr. G.R. Cooper, P. Eng.,
Project Manager

Date Dec. 21/83
Quotation No. 83-03-11-2073
Your Inquiry No. 211-1
Reference: Fuel Storage and Feeding System.

EM NO.	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		one fabricated steel manual slide gate valve, approx. 11" size and complete with handwheel operator, one 2" dia. manual sample port shut off valve with lever handle, one exhaust filter assembly with filter can, replaceable filter cartridge (99.9%) efficient, 3" dia. manual shut off BF valve.		
5.	1	5 ft. dia. bin activator of carbon steel construction and complete with flange mount, hangers, flexible sleeve 1 HP 575/3/60 drive motor and approx. 8" dia. discharge.		
6	1	8" size manual slide gate valve of fabricated steel construction and complete with handwheel operator. Also included is one fabricated steel square to round transition to match bin outlet to slide gate valve, 8" flexible discharge hose, one fabricated steel square to square transition to match slide gate valve to weighbelt feeder.		
		TOTAL ESTIMATING PRICE Items 1 - 6		$ 41,500.00
		As per your request we have enclosed schedule 1 & 2 and also a revised copy of your Fuel Storage and Feed general arrangement dwg..		
		If you have any questions regarding the above, please do not hesitate to contact either myself or Mr. Duncan Robertson.		
		hk		

Terms: Net 30 days, Taxes Extra. Prices Firm for 30 Days.

F shipping point

Delivery: 18 weeks from receipt of written purchase order, approved drawings (if required), and all engineering details.

NOTES:
- Manufacturers' Standard Warranty Only Applies.
- 1 Set Instructions included; additional available at current price.
- Start-Up Service not included but available if required, at current service rates plus mileage and expenses.

J & M INDUSTRIAL SUPPLY LIMITED

B FitzGerald

~~B.~~ FitzGerald
Inside Sales

SCHEDULE I - SCHEDULE OF PRICES

FUEL HANDLING SYSTEM

1.	One (1) fuel handling system as described in the specification, FOB point of ~~sale~~ shipping	$ 41,500.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ 400.00
	TOTAL	$ 41,900.00

SCHEDULE II - TECHNICAL DATA

FUEL HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name ____________________

Vendor's Name J + M INDUSTRIAL SUPPLY LTD

Bin Discharger Model and Type ____________________

Weighfeeder Model and Type 31160 MC Vertical Gate Speed Control Digital Feeder

System total dimensions as package ____________ mm

Unit total weight as package ____________ kg

Bin height ____________ mm

Bin diameter 1500 mm

Discharger diameter 1500 mm

Discharger exciter type Live bottom

Discharger flows

- Minimum w/coal rejects ____________ kg/s
- Maximum w/coal rejects ____________ kg/s
- Minimum w/wood chips ____________ kg/s
- Maximum w/wood chips ____________ kg/s

Weighfeeder belt width ____________ mm

Weighfeeder flows

- Minimum w/coal rejects ____________ kg/s
- Maximum w/coal rejects ____________ kg/s
- Minimum w/wood chips ____________ kg/s
- Maximum w/wood chips ____________ kg/s

* Flows will be sized for your application

Weighfeeder outlet connection dimensions 19.7 x 35.3 mm

Discharger motor

- **Enclosure type** ______________________
- **Manufacturer** ______________________
- **Model** ______________________
- **Temperature rise** __________ °C
- **Power output** __________ kW
- **Frame size** __________
- **Speed** __________ rpm

Weighfeeder drive

- **Type** ______________________
- **Manufacturer** ______________________
- **Model** ______________________
- **Speed ratio** ______________________
- **Power rating** __________ kW
- **Power supply requirements** _______ VA _____ V ____ phase

Weighfeeder motor

- **Enclosure type** ______________________
- **Manufacturer** ______________________
- **Power output** __________ kW
- **Temperature rise** __________ °C
- **Speed** __________ rpm
- **Frame size** __________

Control power requirements

- **Weighfeeder** _______ VA _____ V ____ phase

Feeder power requirements motors and controls 6.5 amperes, 115v, 1 phase

2.0 LIST OF ALTERNATIVES AND EXTRAS

____

____

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____

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order , approved dwgs. and engineering details 4.2 months

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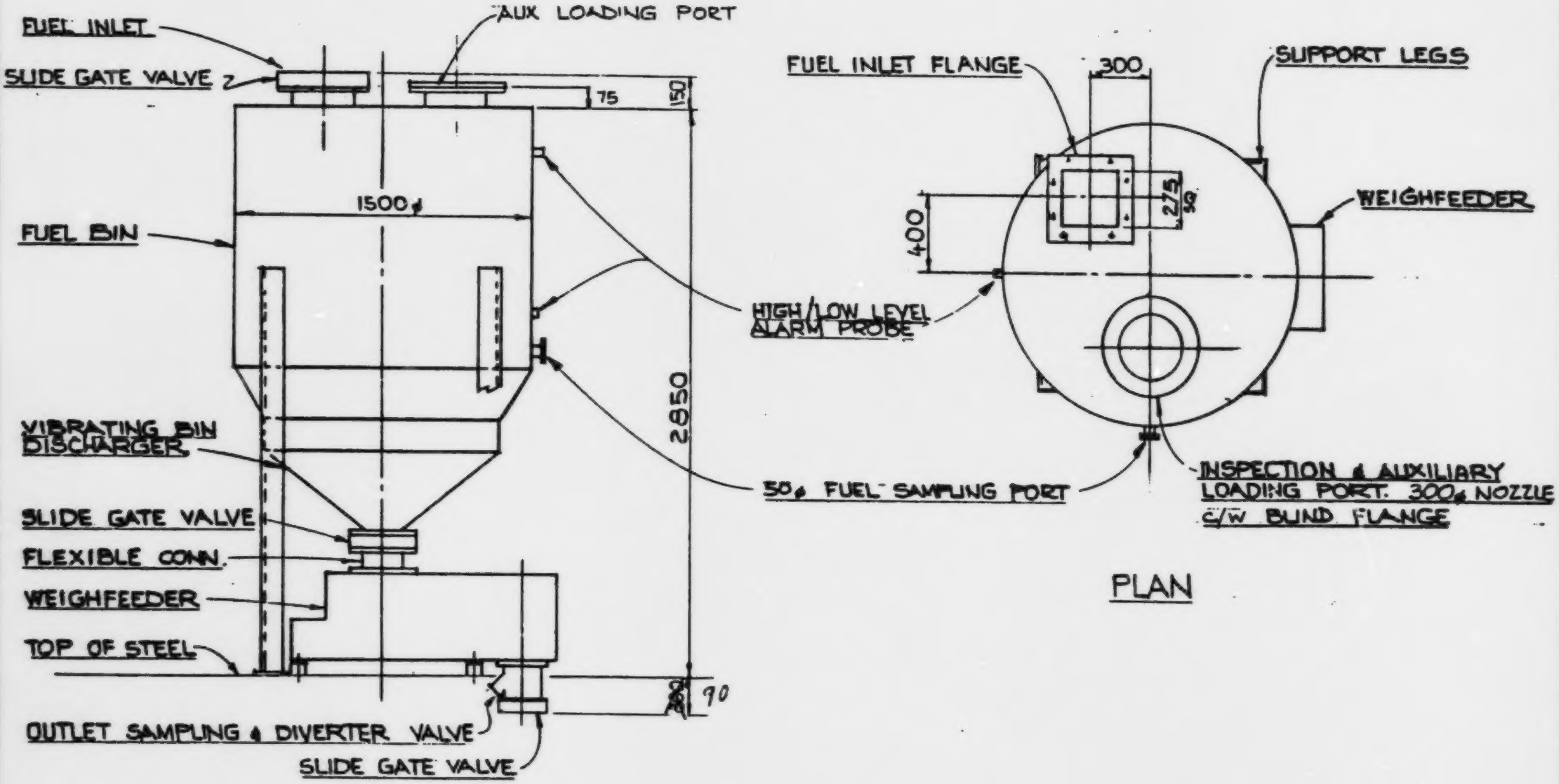
FUEL INLET
SLIDE GATE VALVE
AUX LOADING PORT
75
150
1500φ
FUEL BIN
2850
HIGH/LOW LEVEL ALARM PROBE
VIBRATING BIN DISCHARGER
50φ FUEL SAMPLING PORT
SLIDE GATE VALVE
FLEXIBLE CONN.
WEIGHFEEDER
TOP OF STEEL
90
OUTLET SAMPLING & DIVERTER VALVE
SLIDE GATE VALVE
FUEL INLET FLANGE
300
SUPPORT LEGS
WEIGHFEEDER
400
275
50
INSPECTION & AUXILIARY LOADING PORT. 300φ NOZZLE C/W BLIND FLANGE
PLAN

Design	Drawn	Check	Appd	Issued for	Date	Rev
	LR					

ENERGY MINES & RESOURCES
CANADA

integ

FUEL STORAGE & FEED
GENERAL ARRANGEMENT
B 0243 · SK 211-1 0

212-1

BUCKET ELEVATOR

BIDDER'S LIST

BUCKET ELEVATOR (212-1)

Stephens-Adamson Ltd.
Box 5900, Franklin Street
Belleville, Ontario
K8N 5C8

Rexnord Canada Ltd.
1181 Sheppard Avenue, East
Toronto, Ontario
M2K 1C8

Jervis B. Webb Co. Canada Ltd.
P.O. Box 3428, Stn. "C"
Hamilton, Ontario
L8H 7M5

Attn: Mr. J. Douglas

Ward Ironworks Ltd.
P.O. Box 511
Welland, Ontario
L3B 5R3

FMC of Canada Ltd.
Material Handling Equipment Division
Suite 1, 636 Clyde Ave.
West Vancouver, B.C.

Attn: Mr. J. Wm. Potma

212-1

VANCOUVER, B.C. V6E 2S9
Suite 606
1200 West Pender Street
Telephone (604) 669-5776
Telex 04-51421

EDMONTON, ALTA. T6H 2J7
6019-103A Street
Telephone (403) 436-1707
Telex 037-42791

SUDBURY, ONT. P3A 3T6
767 Barrydowne Road
Telephone (705) 560-1200
Telex 067-7375

TORONTO, ONT. M6A 3A1
Suite 505
1 Yorkdale Place
Telephone (416) 789-7425
Telex 06-969768

MONTREAL, QUE. H4B 2M3
Suite 525
3285 Cavendish Blvd.
Telephone (514) 489-9317
Telex 055-66432

MONCTON, N.B. E1E 4C9
1077 St. George Blvd.
Telephone (506) 382-3612
Telex 014-2237

(BROCHURE)

STEPHENS-ADAMSON

BOX 5900, FRANKLIN ST., BELLEVILLE, ONTARIO, K8N 5C8, CANADA / (613) 962-3411
TELEX 06-62229

BULK MATERIALS HANDLING AND ENGINEERED SYSTEMS

To INTEG LTD.

We STEPHENS-ADAMSON Division of Allis-Chalmers Canada Inc. propose, and will contract to furnish, sell and deliver to you F.O.B. Carrier our Factory Belleville, Ontario,

the following equipment, in accordance with the specifications, terms and conditions stated herein, and the same will substantially conform to enclosed specifications,

accompanying and made a part thereof, and to the following:

DESCRIPTION AND SPECIFICATIONS:

ONE (1) BUCKET ELEVATOR

STEPHENS-ADAMSON INQUIRY NO. 24733
INTEG INQUIRY NO. 212-1
INTEG PROJECT NO. 0243

Proposal No. 1

Date Submitted November 10, 1983

(a)

DIVISION OF ALLIS-CHALMERS CANADA INC.

SA [illegible](1)

BUCKET ELEVATOR

ONE (1) CENTRIFUGAL DISCHARGE TYPE BUCKET ELEVATOR.

CENTRES: 8.4 m (27'- 5")
BELT SPEED: 1.14 m/s (225 F.P.M.)
BUCKET SIZE: 152 mm x 102 mm x 108 mm (6" x 4" x 4-1/4")

DESIGNED TO HANDLE:

MATERIAL: FUEL PROPERTIES
DENSITY: 170 kg./m^3 TO 960 kg./m^3 (10.6 P.C.F. TO 59.9 P.C.F.)
MOISTURE CONTENT: 3.6% TO 57.5%
CAPACITY: DESIGN: 3.6 M.T.P.H. (4 S.T.P.H.)

NOTE: Material quantities listed are for one unit only.

HEAD DRIVE TERMINAL (66.06 R.P.M.)

1 - Shaft, 49 mm (1-15/16") dia. x 838 mm (33") long, with reducer and bearing areas turned to 37 mm (1-7/16") dia. and 1 keyseat.

2 - Standard head shaft seals.

1 - Welded steel pulley, 305 mm (12") dia. x 254 mm (10") crown face compression hubs bored to suite the head shaft. (Pulley supplied with 3/8" Herringbone lagging).

2 - Normial duty ball bearing pillow blocks, 37 mm (1-7/16") dia., series UCP-3 or equal.

REDUCER

1 - Dodge torque-arm reducer, size TDT 125, ratio 25.64:1, output speed 66.06 R.P.M., complete with backstop and TA1 motor mount.

V-BELT DRIVE (1.06:1 RATIO)

1 - Sheave, 76 mm (3.0") O.D., 2 grooves, 3V section.

1 - Sheave, 80 mm (3.15") O.D., 2 grooves, 3V section.

2 - 3V-450 matched V-belts.

1 - Galvanized sheet metal V-belt guard.

MOTOR

1 - 1 H.P., 1800 R.P.M. motor, 3 phase, 60 hertz, 575 volt, explosion proof enclosure, EEMAC design, 'B', frame No. 143T.

NOTE: All wiring, wiring diagrams and controls to be supplied by the Purchaser.

BELT AND BUCKETS

1 - 178 mm (7") wide x 18.6 m (61') long belt Plylon 210, 2 ply, 5 mm x 2 mm (3/16" x 1/16") covers, style 'B' rubber, punched for buckets.

1 - Minet splice with loop rod and rivet setting tube.

58 - Style 'AA' centrifugal elevator buckets, fabricated of 10 gauge mild steel with abrasion lip, size 152 mm x 102 mm x 108 mm (6" x 4" x 4-1/4") punched for 6 mm (1/4") dia. bolts.

BOOT AND TAILSHAFT

1 - Elevator boot fabricated of 4 mm (10 gauge) mild steel plate, with angle stiffeners, removable front and back panels, and 45° feed inlet.

1 - Shaft, 49 mm (1-15/16") dia. x 610 mm (24") long, with shaft ends turned to 37 mm (1-7/16") dia. for bearings.

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2 - Screw type take-ups fitted with Normial duty 4 bolt flange mount ball bearings, 37 mm (1-7/16") dia., series UCF2 or equal.

2 - Standard tail shaft seals.

1 - Plain type pulley, 254 mm (10") dia. x 254 mm (10") crown face, compression hubs bored 49 mm (1-15/16") dia.

CASING AND HOOD

(STANDARD DUST TIGHT CONSTRUCTION)

1 - Fabricated steel elevator casing, 286 mm x 845 mm (11-1/4" x 33-1/4") inside, consisting of approx. 6 meters (19'- 0") of intermediate casing fabricated of 10 gauge mild steel plate.

1 - Head section 1.52 meters (5'- 0") long with standard discharge spout and head terminal bearing supports. Head section and spout fabricated of 10 gauge mild steel.

1 - No. 14 gauge mild steel split removable hood.

2 - Standard bolt-on type inspection doors.

1 - Fabricated steel torque-arm support.

GENERAL NOTES

ASSEMBLY:

The head section is shipped assembled including with drive shaft, pulley, seals, discharge spout and hood. The drive and holdback are shipped dis-assembled for protection during shipment.

The boot section is shipped assembled including tail shaft, screw take-ups, pulley, seals and feed inlet.

The elevator casings are shipped in nominal 10 ft. sections.

The belt is provided prepunched for the buckets.

PAINT:

All exterior surfaces of the casing will be cleaned in accordance with Stephens-Adamson standard shop practices and painted with one (1) shop coat of our standard blue paint. This paint is an epoxy ester zinc-chromate phenolic primer.

All purchased items such as motors, reducers, bearings etc. are provided in the manufacturer's standard finish. Galvanized components will not be painted.

MANUALS:

Stephens-Adamson's basic price includes four (4) copies of installation, operation and maintenance manuals in the English Language. These manuals also include "as built" certified arrangement and/or assembly drawings.

See our option price sheet for other manual availability.

EXCLUSIONS:

Any equipment not outlined in the preceding specification is not included and is considered as being supplied by others.

PRICE SHEET

BASIC PRICE :

The price to supply one (1) BUCKET ELEVATOR as outlined in the preceding specifications will be ....$ 11,100.00

Estimated weight ... 2,669 Lbs.

OPTIONS:

We offer the following options at the add on price shown:

(1) Extra copies of English Language maintenance manuals are available.

Add on per manual ....$ 50.00

(2) French Language manuals are offered which would provide Stephens-Adamson information in the French Language and sub vendor (reducers, bearings, motors, etc.) information to the extent available in the French Language.

Add on for up to four (4) such manuals ....$ 200.00

Add per additional copy ....$ 50.00

BID VALIDITY:

All above pricing is F.O.B. Belleville, Ontario, with all applicable taxes being extra. Further this pricing will be held firm through the quoted delivery period and is open for acceptance for thirty (30) days from the date of this proposal.

DELIVERY:

Based on current engineering and manufacturing schedules we estimate that delivery of this equipment will require 14-16 weeks from receipt of written order.

If delivery becomes critical, we would like to be given the opportunity to review and discuss our quoted delivery period with you.

..../2

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1.	One (1) bucket elevator as described in the specification, FOB point of sale	$ 11,100.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ N/A
3.	Transportation to site (Estimated)	$ 230.00
	TOTAL	$ 11,330.00

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name	Stephens-Adamson Division Of Allis-Chalmers Canada Inc.	
Vendor's Name		
Model and Type	Elevator No. SB 064-A, Type Centrifugal	
Casing size	286 x 845	mm
Total height	9342	mm
Discharge height	8350	mm
Shaft center distance	8400	mm
Inlet flange dimensions	305 x 286	mm
Discharge spout flange dimensions	280 x 286	mm
Belt material	2 ply rubber	
Belt width	178	mm
Bucket material	10 Gauge Mild Steel	
Bucket type	Style 'AA' Centrifugal	
Elevator maximum capacity	8	m^3/h
Elevator motor		
- Enclosure type	Explosion Proof	
- Manufacturer	Brook Crompton	
- Speed	1800	rpm
- Power output	0.7547	kW
- Temperature rise	40	°C
- Frame size	143T	

Elevator drive

- Type	Shaft Mounted Reducer
- Manufacturer	Dodge Canada
- Model	TDT 125
- Speed ratio	25.64:1

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

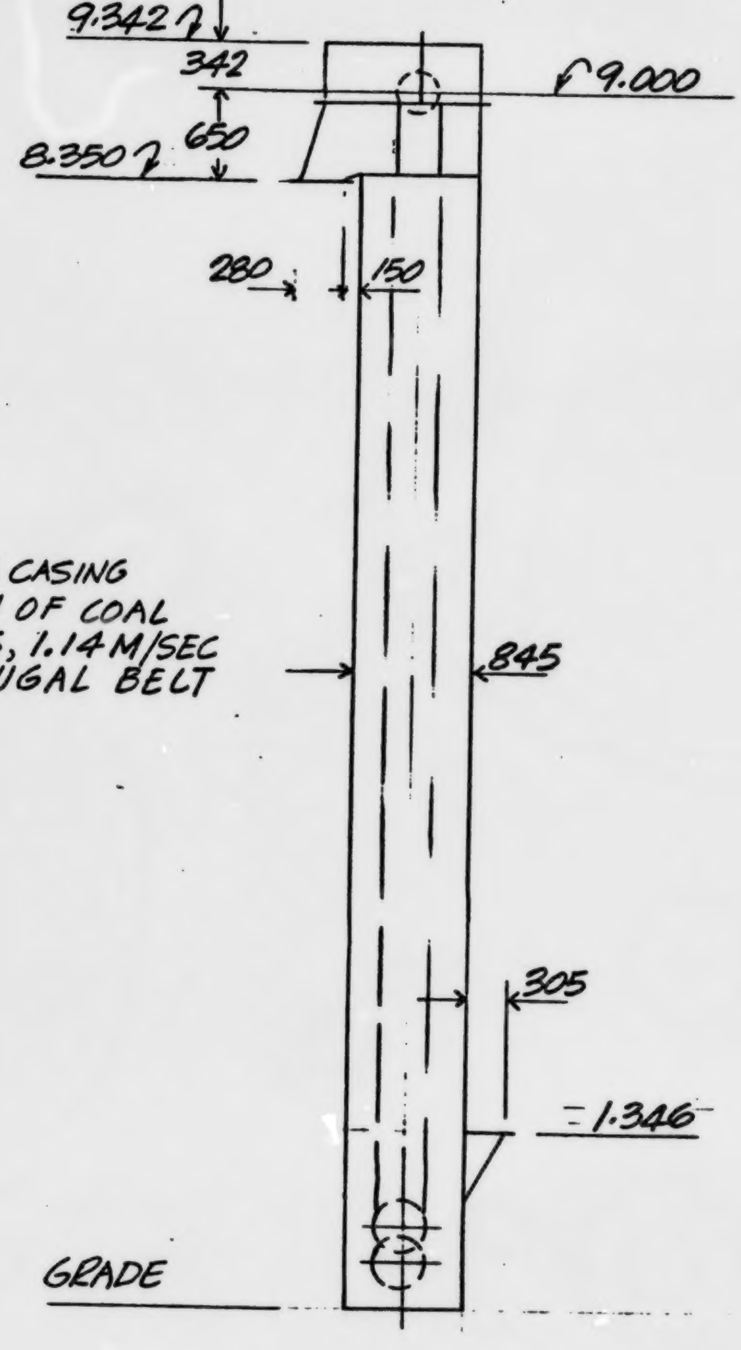
Time required for manufacture and shipment from receipt of order	Four (4) months

NOTICE C DENTIAL PROPERTY OF
ALLIS-CHALMERS CORP.

STEPHENS-ADAMSON
DIVISION OF ALLIS-CHALMERS CANADA LIMITED BELLEVILLE, ONTARIO

TITLE	PROPOSED BUCKET ELEV INTEG
DRAWING NO.	LSB—30329-1
REV.	
APPROVED	
INQ Nº	24733
DRAWN	SAE
CHECKED	
DATE	4 NOV 83
ORDER No.	

REV.	SEE NOTICE
A	
B	
C	



9.342
342
9.000
650
8.350
280
150
845
305
1.346
GRADE

- 285×845 CASING
- 3.6 MTPH OF COAL REJECTS, 1.14 M/SEC CENTRIFUGAL BELT

LSB—30329-1

212-1

Proposal

Rexnord

Rexnord Canada Ltd.
Conveyor and
Components Division
1181 Sheppard Ave. E.
Willowdale, Ont.
M2K 1C6
416/221-9361

Integ-Intercontinental Engineering Ltd.
1155 West Pender St.
Vancouver, B.C.
V6E 2P4

Attention: G. R. Cooper, P. Eng.
Project Manager

BUYER INQUIRY NO. 212-1	DATE 21 October 83
BUYER SPECIFICATION NO. 0243-212	DATE 21 October 83
BUYER DRAWING NO. --	DATE --
SELLER PROPOSAL NO. PV84-801-110	DATE 14 November 83
SELLER DRAWING NO.	DATE

REXNORD CANADA LTD. proposes to furnish the Rexnord Equipment as described in the referenced specifications and drawings for the purchase price of:

$ See Price Summary

Approx. Shipping Weight: 3000 lbs.

The price includes only the following marked items. All other items are the Buyer's responsibility.

☒ Equipment FOB Willowdale, Ontario
☐ Freight Prepaid
☐ Federal Taxes
☐ Provincial Taxes
☐ Field Unloading
☐ Field Mechanical Installation
☒ Manuals
☐

Upon receipt of Purchaser's order and complete information, Seller will ship this equipment in approximately 12 - 14 weeks. Additional time will be necessary if Purchaser delays return of final approval drawings beyond two weeks, or if delivery of the equipment is delayed due to changes, lack of information from Purchaser, or any other conditions beyond Seller's control.

This proposal offer is void unless accepted by the Purchaser within 30 days from date appearing on this proposal.

Date November 14, 1983

PAYMENT AND PRICE TERMS

Terms of payment are: n/30 upon shipment, or when ready for shipment if shipment is deferred by Purchaser. Prices quoted will be firm for orders accepted at the factory where material is scheduled by REXNORD for shipment before n/a; otherwise REXNORD reserves the right to apply prices in effect at the date of shipment. REXNORD prices do not include sales, use, excise or other similar taxes and all such taxes shall be paid by Purchaser. The price in the quotation includes 3 service manuals. Prices for additional copies will be quoted on request. REXNORD prices do not include the cost of premiums for any bond, or bonds, which Purchaser required REXNORD to furnish and all such premiums are to be paid by Purchaser. ALL ORDERS ARE SUBJECT TO REXNORD CREDIT APPROVAL.

Rexnord Canada Ltd.

By DJBristow.
D. J. Bristow, P. Eng.
Estimator - Contract Sales

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(See Terms and Conditions of Sale on reverse side)

CONDITIONS OF SALE

1. **SHIPMENT**: Shipment is F.O.B. REXNORD shipping point and occurs when products are delivered in good order to the carrier, whereupon REXNORD responsibility for the products ends. If shipment as originally specified is delayed by Purchaser, REXNORD reserves the right to invoice Purchaser and store the products at Purchaser's expense.

2. **INSTALLATION**: All products specified in the quotation shall be assembled and installed by Purchaser at Purchaser's expense.

3. **PAINTING**: Before shipment, REXNORD will apply one coat of standard paint to all structural and plate work and will cover all exposed finished machinery parts with a suitable protective coating. Touch-up paint can be supplied by REXNORD on request.

4. **CANCELLATION OR SUSPENSION**: REXNORD shall not be liable for damages occasioned by a delay in performance or delivery due to causes beyond the reasonable control of REXNORD, and the time for delivery will be extended for a period equal to the time lost by reason of any such delay. Cancellation or suspension by Purchaser will only be accepted on terms indemnifying REXNORD against loss.

5. **WARRANTY**: REXNORD warrants that its products will be of good merchantable quality, free from defects in material and workmanship and will possess the characteristics represented in writing by REXNORD. Claim for breach of the above warranty must be made within eighteen (18) months from the date of delivery to the Original User or twelve (12) months from the date of readiness for operation, whichever is sooner. Upon satisfactory proof of claim, REXNORD will, within a reasonable time, make any necessary repairs, additions, or corrections, or, at the option of REXNORD replace defective parts free of charge. Charges for correcting defects or making additions will not be allowed, nor will REXNORD accept products returned for credit unless the return or correction is authorized by REXNORD in writing. THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION OF THE PRODUCT. This warranty statement sets forth the extent of the liability of REXNORD for breach of any warranty or deficiency in connection with the sale or use of the products. It is understood that REXNORD will not be liable for consequential damages of any nature, including, but not limited to, loss of profit, delays or expense, whether based on tort or contract.

6. **SAFETY DEVICES**: The products are provided with only those safety devices identified herein. IT IS THE RESPONSIBILITY OF PURCHASER TO FURNISH APPROPRIATE GUARDS FOR MACHINERY PARTS as well as any other safety devices desired by Purchaser and/or required by law.

7. **PATENTS**: REXNORD will defend and hold harmless Purchasers of the products identified herein against charges of infringement of apparatus claims of Canadian Patents issued at the time of acceptance of the order by REXNORD, provided such charges are based exclusively on mechanical infringement by products designed and manufactured by REXNORD. Before this responsibility shall arise, REXNORD must be notified in writing and tendered the right to defend, settle, or make any changes in the products for the purpose of avoiding infringement. Under no circumstances will REXNORD liability exceed the purchase price of the products furnished by REXNORD.

8. **CHANGES, DELAYS AND UNUSUAL COSTS**: If Purchaser requests or causes changes to be made in design or construction of the products, or if Purchaser delays the progress or work covered by the quotation, the contract price will be adjusted to reflect any increase or decrease. Additional charges may be made to cover any unforseen or unusual cost elements which have not been contemplated by REXNORD or Purchaser, including, but not limited to, overtime work authorized by Purchaser, and special packing, engineering and documentation.

9. **TITLE AND OWNERSHIP**: Title of the products described in the quotation and the right of repossession remains with REXNORD until final payment is made by Purchaser. In the event of default on any payment, the full amount unpaid shall become due and payable at any time during the continuance of the default and REXNORD may repossess the products and retain the right to collect the balance of the contract price. The products or any part thereof shall not be considered fixtures or be incorporated into realty by reason of attachment thereto, and may be separated from realty for the purpose of repossession.

10. **SUPERINTENDING INSTALLATION**: Services of a factory representative to superintend or inspect installation and/or first operation of the products specified in the quotation can be furnished by REXNORD at the following rates:

    A. Supervision or inspection within Canada ________________ dollars per eight (8) hour day, Monday through Friday inclusive. Overtime Monday through Friday and Saturday work, at time and one-half. Time worked in excess of twelve (12) hours on any one day, Sunday and Holiday work, at double time.

    B. Traveling, living and incidental expenses at cost, including shipping charges on tools and other equipment which the factory representative has shipped to the construction site.

    C. Travel time will be charged to and from Purchaser's construction site, and weekend or Holiday travel requested or required by Purchaser will be charged at the overtime rates.

    Rates shown above apply only to services performed within twelve (12) months from the date of quotation. Services performed after that time are subject to then current rates. Except for the direct acts or omissions of the factory representative, the responsibility for the installation and/or first operation shall be Purchaser's. REXNORD will assume responsibility for workmen's compensation coverage of REXNORD employees only, and will provide umbrella liability coverage during installation. All other insurance coverage and necessary materials to accomplish installation shall be provided by Purchaser.

11. **MANUFACTURING DEVICES AND TECHNICAL INFORMATION**: Unless otherwise agreed, all manufacturing devices, designs, data or other technical information relating to the quotation shall remain the property of REXNORD.

12. **PROCESS PERFORMANCE**: Process design will be determined, normally, on the basis of theoretical analysis. The laboratory testing fee, pertaining to process performance, is One Hundred and Fifty Dollars ($150.00) for a period not to exceed a normal work day duration. REXNORD suggests the presence of Purchaser's personnel during a test so that performance is judged and accepted by Purchaser. This fee is refundable on a purchase of Process Equipment within a sixty (60) day period from date of testing.

13. **DRAWINGS**: REXNORD will submit two sets of final general assembly drawings for Purchaser's approval. If on receipt of drawings, Purchaser requests construction and/or design changes, REXNORD will submit a revised price and shipping date. Upon Purchaser's approval, REXNORD will proceed with production in accordance with the drawings, as revised and approved.

14. **COMPLETE AGREEMENT**: THE COMPLETE AGREEMENT BETWEEN REXNORD AND PURCHASER IS CONTAINED HEREIN AND NO ADDITIONAL OR DIFFERENT TERM OR CONDITION STATED BY PURCHASER SHALL BE BINDING ON REXNORD UNLESS AGREED TO BY REXNORD IN WRITING. The quotation shall become a contract when accepted by Purchaser in writing and finally confirmed by an authorized executive of REXNORD. Failure of REXNORD to insist upon strict performance of any of the terms and conditions stated herein shall not be considered a continuing waiver of any such term or condition or any right of REXNORD.

15. **IF THE QUOTATION COVERS REXNORD VIBRATING EQUIPMENT, THESE ADDITIONAL CONDITIONS APPLY:**

    A. CAPACITIES AND PERFORMANCE: Specific capacities will not be warranted unless Purchaser furnishes detailed and complete physical characteristics of the material to be conveyed and until capacities are confirmed by an accurate conveying test using material furnished to REXNORD by Purchaser. If these requirements are not met, the sizing of equipment for capacity will be based on the normal capacity for a granular material, such as damp sand, having a bulk density of 100 PCF. Capacities and performance cited in quotations are theoretical only, but they can be warranted, if agreed to in writing by REXNORD.

    B. DYNAMIC REACTION: Rex Vibrating Equipment Division vibrating products are available in four designs which affect the dynamic reaction imposed upon the supporting structure. These designs are: 1. Standard, 2. Balanced, 3. Isolated, and 4. Balanced-isolated. Approximate reactions for proposed equipment will be furnished to Purchaser upon request. Final magnitude and frequency limits of dynamic reactions will be shown on the construction drawings. These reactions must be analyzed by Purchaser from a deflection standpoint relative to rigidity, strength, and loading of supports; as well as the effect of these reactions on foundation, the transmissibility of the soil, and any other environmental aspects. REXNORD assumes no responsibility for direct or indirect damage caused by these reactions. A vibration warranty can be extended, if requested, at a predetermined special fee.

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1.	One (1) bucket elevator as described in the specification, FOB point of sale	$ 14,260 (budget)
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ --
3.	Transportation to site (approx.)	$ 220.
	TOTAL	$ 14,480.00

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name	Rexnord Canada Limited	
Vendor's Name	"	
Model and Type	1206 Centrifugal Discharge, Belt Type	
Casing size	356 x 1245	mm
Total height	10185	mm
Discharge height (assumed)	8534	mm
Shaft center distance	8712	mm
Inlet flange dimensions	127 x 660	mm
Discharge spout flange dimensions	368 x 400	mm
Belt material	Goodyear Plylon	
Belt width	178	mm
Bucket material	1020 steel plate	
Bucket type	Style A-A, 152 x 102 x 114	
Elevator maximum capacity	8.50	m^3/h
Elevator motor		
- Enclosure type	Type K, explosion-proof	
- Manufacturer	Canadian General Electric	
- Speed	1750	rpm
- Power output	1.11	kW
- Temperature rise	40	°C
- Frame size	182T	

Elevator drive

- Type	V-belt and shaftmounted speed reducer
- Manufacturer	Dodge Canada Ltd.
- Model	TDT 225
- Speed ratio	25 to 1

2.0 LIST OF ALTERNATIVES AND EXTRAS

** See Below

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3½ to 4 months

** Items Not Included In This Proposal

- Electrical wiring and controls
- Service platforms, ladders and external supports
- Chutes
- Shop assembly and shop testing of elevators
- Field erection, testing, commissioning and start-up
- Transportation to jobsite
- Unloading and storage of equipment on site
- Utilities
- Special Paint

NOTE: Although Rexnord Bucket Elevators are designed to be self-supporting, they are not free-standing. External bracing is required at appropriate intervals along casing.

212-1

Jervis B. Webb Company OF CANADA

CUSTOM ENGINEERED CONVEYING SYSTEMS 1647 BURLINGTON STREET EAST, HAMILTON, ONTARIO, CANADA (416) 547-0411
ADDRESS CORRESPONDENCE TO: P.O. BOX 3428, STN. "C", HAMILTON, ONTARIO L8H 7M5

December 5, 1983

integ
DEC-9 1983
GRC

Integ
International Engineering Limited
1155 West Pender Street
Vancouver, British Columbia
V6E 2P4

Attention: Mr. G. R. Cooper, P. Eng.,
Project Manager

Reference: Bucket Elevator - Your Inquiry No. 212-1
Our File No. PB-83-777

Gentlemen:

We are pleased to submit our price to supply only one (1) bucket elevator, per your specifications and our Proposal.

Trusting the enclosed meets with your approval.

Yours very truly,

JERVIS B. WEBB COMPANY CANADA, LTD.,

J. Douglas

J. Douglas
Hamilton District Sales Manager

JD:kh
encl.

ANN ARBOR · ATLANTA · AUCKLAND · BARCELONA · BELLEVILLE · BOYNE CITY · BRUSSELS · BUENOS AIRES · CARACAS · CLEVELAND · COHASSET DETROIT
HAMILTON · HARBOR SPRINGS · KARLSRUHE KRAGUJEVAC · LONDON · LOS ANGELES · MEXICO CITY · Mt. VERNON · OSAKA PARIS · PELLSTON · SAO PAULO · SYDNEY TORINO

Proposal Number PB-83-777 Proposal Date **December 5, 1983**

Jervis B. Webb Company of Canada, Ltd
1647 Burlington Street East, HAMILTON, Ontario L8H 7M5 P.O. Box 3428 Stn. C

TO:
Integ
International Engineering Limited
1155 West Pender Street
Vancouver, British Columbia
V6E 2P4

ATTN:
Mr. G. R. Cooper, P. Eng.,
Project Manager

GENTLEMEN:

1. We, the JERVIS B. WEBB COMPANY OF CANADA, LIMITED, a Canadian Corporation, propose, and will contract to furnish, sell and deliver to you, F.O.B. Hamilton, Ontario, the following equipment in accordance with the specifications, terms and conditions stated herein; the same will substantially conform to:

Your Inquiry No. 212-1

DWG Nos. ______________________________

Dated: ______________________________

accompanying and made part hereof, to the following:—

One Only - Bucket Elevator

2. MATERIAL TO BE HANDLED:
(Size, weight, capacity)

Fluid Coke (Minus 100 Mesh), Coal Rejects (Minus 19 mm), wood chips (Minus 50 mm), Peat (Minus 28 Mesh).

at 1 kg/sec. rate

3. OPERATION OF SYSTEM:

One Only - Centrifugal Discharge Belt-Type Bucket Elevator

Capacity:	30 m^3/hr. max.
Overall Height:	9340 mm max.
Shaft Centers:	8784 mm
Material Density:	960 kg./m^3 max.
Material Size:	50 mm max.
Bucket Size:	250 x 150 mm
Belt Width:	280 mm
Head Pulley Dia.:	610 mm
Foot Pulley Dia.:	508 mm
Bucket Spacing:	406 mm
Casing Size:	400 x 1220 mm Boot Section Mounted in a 1000 mm Pit Below Floor Level.
Motor:	3 HP Exp. Pf.
Belt Speed:	250 FPM
Drive:	Dodge TDT 225 Shaft Mounted
Belt:	Goodyear Plylon 330 with 2.4 mm Type B. Covers.
Buckets:	Abrasion Resistant Polyethylene
Bearings:	Dodge SCM Series
Take-Up:	Screw Type
Casing:	Continously welded for dust seal feature. Include all necessary inspection and access doors. Shaft seals at head shaft.

Feed Hopper: Included
No top grid or grating.

We Have Not Included: any motion probe switch, chutework, service platform, ladder, foundation bolts, motor starter and wiring

5. INSTALLATION:

All of the equipment herein specified shall be installed by you and at your expense.

6. PAINTING:

Before shipment, we will apply one coat of paint to all shop fabricated, structural and plate work, and grease or oil all exposed finished machinery parts. If prime coat is to be other than our standard shop grey, it must be so stated in your bid specifications.

7. SAFETY DEVICES:

We shall not be required to furnish any safety devices or guards, required by law or otherwise, except those specified herein.

8. EQUIPMENT WARRANTY:

In lieu of all other warranties, express or implied, we warrant the equipment covered by this proposal, not manufactured by others, to be free from defects in material and workmanship under normal use and service, and when properly maintained. Use or service with corrosive or abrasive chemicals or materials shall not be deemed normal.

Our obligation under this warranty is limited to repairing at our factory or furnishing a replacement for any part or correcting at our factory, any workmanship which shall be demonstrated to our satisfaction to have been defective at the time of shipment and with respect to which a written claim specifying the particular defect or defects shall have been delivered to us within one (1) year from time of shipment or before the equipment has had twenty-one hundred (2100) hours of running use, whichever period is the shorter. Defective parts shall be returned to us F.O.B. our factory and repair or replacement parts shall be shipped by us F.O.B. our factory. We do not warrant equipment manufactured by others, but will submit to you upon request the manufacturer's warranty. We neither assume, nor authorize any other person to assume for us, any other liability in connection with the equipment covered by this proposal, including, without limiting the generality of the foregoing, liability for loss of production, product, equipment or profits and liability for consequential damages or any damages to persons or property. We will make no allowances for repairs, alterations or other work done unless specifically agreed to in writing.

9. PATENTS:

With respect to proposed equipment of our manufacture or design, we undertake to save you harmless from all judgement, decrees, costs and expenses resulting from any charge of infringement, of a Canadian patent issued prior to the date of this proposal, based upon the use or sale by you of any such proposed equipment in the form supplied by us and in the manner we recommend or in the manner in which such equipment is customarily used; provided that upon the receipt of any such charge of infringement by you, we are immediately notified in writing and are given complete control of the defense, with the right to defend, settle or make changes in such proposed equipment for the purpose of avoiding infringement; and it is mutually agreed that the obligation herein set forth is our only obligation with respect to patent infringement.

10. CHANGES AND DELAYS:

Should the work be delayed by you or for any other reason beyond our control, you will pay us for any loss, damage and additional expense suffered or incurred by us as a result of such delays.

In the event such delay involves a delay in shipment of the equipment, you will pay us the extra cost of storing and handling the equipment during the period of delay and if the delay in shipment exceeds forty-five (45) days from the date the equipment is ready for shipment, the entire purchase price plus the extra cost of storing and handling them accrued shall be due and payable forty-five (45) days after the date the equipment is ready for shipment and all charges subsequently accruing shall be due and payable at the end of each thirty (30) day period thereafter or upon shipment, whichever occurs first.

We reserve the right to make changes in design or material which in our judgement are for improvements in the equipment and/or its operation and which involve no change in the contract price. No other changes shall be made other than pursuant to written order signed by you and us setting forth the details and terms and conditions thereof (including changes in the delivery and/or installation schedule and in price, if any).

It is understood that a proper cancellation claim figured in accordance with this contract will be honored on the basis of expenses, costs and liabilities accumulated and/or incurred at the time of receipt at our main office of written notice of cancellation plus a reasonable cancellation charge to cover extra cost of handling and profit.

Delivery promises on all material are based on the present promises of our suppliers. All deliveries are subject to change as determined by Government restrictions and priorities and by actual deliveries by our suppliers.

11. ESCALATION:

The current economic instability makes it impossible to predict escalation reliably. Rather than burden the pricing with large built-in estimated allowances for possible escalation, our prices are based on current quotations from vendors, which are predicted on immediate shipment of the equipment.

The prices quoted hereinafter are all subject to escalation, based either upon escalation formulae utilizing Statistics Canada price indices, or upon actual price increases which are subject to verification by future audit.

To all price increases determined by either of the above methods shall be added our standard burdens and administrative expenses.

Vendor quotations used in this proposal shall serve as a base for any future escalation determination. These quotations will be made available to you at time of order.

Escalation involving Webb material or labour shall be substantiated by audit.

12. CLAIMS:

We will consider no claim for shortage or errors unless made immediately upon receipt of shipment. We are not to be held liable for delays, damage or loss due to shortage of materials, strikes, lockouts, differences with employees, accidents, fires, explosions, delays in manufacture, transportation or delivery of materials, acts of God, embargoes, inability to ship, inability to insure against war risks, Governmental action, or insurrection or any other causes beyond our control, whether the same as or different from the matters and things herein before specifically enumerated.

13. EXAMINATION AND TESTING:

In view of the special nature of conveying equipment, it is a physical impossibility to fabricate the order in our factory so that certain adjustments and minor alterations will not be necessary in the field after installation. This is particularly true on large jobs, or wherever two or more units must operate in conjunction. In such cases, we earnestly recommend that you avail yourself of the services of one of our skilled erection supervisors.

Should you so desire, we will provide for you the services of a competent person to superintend the installation and initial operation of the herein specified equipment; this offer is independent of other provisions of this proposal, and you shall reimburse us for our expense in the matter (weekly) (monthly) at the rate of $ ______________________ per eight (8) hour day, based upon the prevailing schedule of straight-time hours in the locality in which this installation is to be made. Additional charges will be made on the above schedule, for overtime, Saturday, Sunday, or holiday work, and for travel and living expenses of such person during the time he is away from our factory on your business.

14. USE OF SPECIFICATIONS AND DRAWINGS AND RESERVATION OF COPYRIGHTS:

We reserve all copyright rights in this proposal and in all accompanying specifications and drawings. This proposal and all such specifications and drawings are submitted to you solely for your consideration and in confidence, remain our property subject to recall by us, and are not to be published, reproduced, copied in whole or in part, loaned or otherwise communicated to any third party without our written permission. Drawings accompanying this proposal are not to be used for construction purposes.

15. TIME AND EFFECT OF ACCEPTANCE:

This proposal expires at our option unless acceptance be received at our main office within fifteen (15) days from the proposal date. This proposal is not an offer and its acceptance shall not constitute a contract unless and until such acceptance is approved at our main office by one of our officers or duly authorized representatives. Issuance of an order or acceptance of this proposal constitute acceptance of all conditions described herein.

16. PURCHASE PRICE AND TERMS OF PAYMENT:

The purchase price for the equipment herein specified is: —

$13,000.00

(Thirteen thousand, Dollars)

($.........................)

payable in Canadian funds at par in Hamilton, Ontario as follows:

Federal, Provincial and Municipal taxes are extra where applicable.

Ninety percent (90%) cash for material as shipped, except as provided above in case of delays and shipment.

Balance thirty (30) days thereafter.

Overdue payments are to bear interest at the legal rate.

Terms of payment shall in no way be affected should the equipment be damaged or destroyed subsequent to transfer to carrier, by fire, the elements or by any other cause.

JERVIS B. WEBB COMPANY OF CANADA, LIMITED

C.D. Allman.

By C. D. Allman
Manager
Bulk Systems Division

APPROVED AT HAMILTON, ONTARIO:

Date December 5, 1983

By C. D. Allman
Manager
Bulk Systems Division

PURCHASERS ACCEPTANCE:

Date

Company

By

Proposal Number PB-83-777

Proposal Date: December 5, 1983

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1.	One (1) bucket elevator as described in the specification, FOB point of sale	$ 13,000.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ Nil
3.	Transportation to site	$ 305.00
	TOTAL	$ 13,305.00

All Taxes Extra

F.O.B. Our Works - Hamilton, Ontario

Freight Allowed to Site, Ottawa, Ontario

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name	Jervis B. Webb Company of Canada, Limited	
Vendor's Name	Jervis B. Webb Company of Canada, Limited	
Model and Type	Centrifugal Discharge	
Casing size	400 x 1220	mm
Total height	9,000	mm
Discharge height	7,298	mm
Shaft center distance	8,784	mm
Inlet flange dimensions (inside)	400 x 400	mm
Discharge spout flange dimensions (inside)	406 x 432	mm
Belt material	Nylon	
Belt width	280	mm
Bucket material	Plyethylene	
Bucket type	AA	
Elevator maximum capacity	30	m^3/h
Elevator motor		
- Enclosure type	Exp. Pf.	
- Manufacturer	Westinghouse	
- Speed	1800	rpm
- Power output	2.2	kW
- Temperature rise	40	°C
- Frame size	182T	

Elevator drive

- **Type**	Shaft Mounted
- **Manufacturer**	Dodge
- **Model**	TDT 225
- **Speed ratio**	25:1

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3 **months**

212-1
([illegible] [illegible])

WARD

WARD IRONWORKS LIMITED

123 VICTORIA STREET · WELLAND · ONTARIO · CANADA · L3B 5R3 · TELEPHONE (416) 732-7591 TELEX: 061-5321
MAILING ADDRESS: P.O. BOX 511, WELLAND, ONTARIO L3B 5R3

28th November 1983.
Proposal No. WI-9

integ
DEC - 1 1983

CIRC.	DATE
RLC	

FILE

Intercontinental Engineering Ltd.,
1155 West Render Street,
Vancouver, B.C.
V6E 2P4

Attention: G.R. Cooper, P.Eng.,
Project Manager.

Reference: Your File 0243-E1.

Gentlemen:

(1) We are pleased to quote as follows F.O.B. our plant, Welland, Ontario, on the Engineering, Supply, Fabrication, Sub-shop Assembly and Painting of One only WARD Model E Bucket Elevator in accordance with your inquiry dated 21st October 1983 attached, specifications, and WARD drawing S-1811 enclosed.

Detailed specifications of the Equipment we propose to furnish will be as outlined on page 2.

The purchase price, items not included, delivery and terms and conditions are specified on pages 3, 4, and 5.

(Continued)

Engineering, Production, Installation Of Foundry Equipment/Systems. Bulk Material Handling/Processing Equipment/Systems.
Custom Built Machinery, Machine Shop Services, Pollution Control Equipment/Systems.
Pneumatic Conveying Systems, Air Blending, Weigh Batching, Heavy Duty Vacuum Equipment.

We will furnish one only WARD Model "E" Centrifugal Discharge Type Bucket Elevator size 6"x4"x28'-7-3/4" crs. Rated at 9m^3 /hr. at a belt speed of 260 fpm. The details will be as follows:

DRIVE:

1 motor 1.5 HP @ 1800 RPM TEFC
1 reducer Dodge Torque Arm Model TDT225 Class III rating complete with built in Backstop
1 v-belt sheave 6.4 P.D. 1B Groove
1 v-belt sheave 9.4 P.D. 1B Groove
1 v-belt size B60
1 standard v-belt guard 3 sided type

HEAD TERMINAL 113 RPM:

1 steel pulley 8" dia. x 10"CF bore 1-15/16" dia.
1 item 3/8" Rubber lagging applied
1 alloy steel shaft 1-15/16" dia. x 30" long 3KS
2 pillow blocks 1-15/16" dia. Dodge Type"SC"

TAIL TERMINAL:

1 slatted steel pulley 8" dia. x 10" CF bore 1-7/16" dia.
1 alloy steel shaft 1-7/16" dia. x 20" long 2KS
2 take-up blocks 1-7/16" dia. Dodge Type"SC"
2 standard take-up frames 6" travel

BELT & BUCKETS:

1 elevator belt 7" wide x 62'-0" long P.V.C.
125 elevator bolt assemblies including rubber washer, lock washer, and hex nut
55 Elevator buckets WARD style A, 10 ga., A.R. Steel,size 6"x4"x4¼" on 13" crs.

CASING:

1 boot section fabricated from 10 ga. steel plate with 2 side doors, 1 back door for service, 1 clean out door and 1 item shaft seals.
1 item intermediate sections x 23'-7-3/4" x 12 ga. Plate
1 head section fabricated from 10 ga. steel Plate with standard discharge outlet, one inspection door and 14 ga. hood.
1 inlet chute fabricated from 10 ga. steel Plate

FABRICATION:

1 Item fabrication labour including painting, 1 coat each primer and enamel paint and one item shop-sub assembly

ENGINEERING:

1 Item Engineering including General Arrangement Drawing, Bill of Material, and Installation and Operating Instruction Manuals.

(Continued)

2. **Purchase Price**

The purchase price for the material, equipment and services described above will be

a) One (1) Bucket Elevator per above spec.	$8,370.00
b) Optional Extra for Complete Shop Assembly	$ 900.00
c) Freight to Jobsite Ottawa	$ 270.00
TOTAL	$9,540.00

TERMS OF PAYMENT: Monthly progress billings based on work completed at the end of each calendar month.

3. **Items Not Included**

a) Foundations and Foundation Bolts.
b) Freight.
c) Installation Labour, materials and Equipment.
d) Field Electric Wiring and Conduit.
e) Anyghing not specified under item descriptions.

4. **Delivery**

2 Weeks General Arrangement Drawings
6 Weeks Fabrication

5. **Duty and Taxes**

(a) In addition to the specified purchase price, you agree to pay to us the amount of any and all taxes, duties, excises, license fees and other charges levied, assessed or imposed upon us by reason of and/or applicable to the manufacture, sale, purchase and delivery of material, equipment or any parts thereof, as well as the amount by which the cost of such manufacture is increased by reason of any law, ordinance or regulation adopted or promulgated by any government or government sub-division, department or agency after the date hereof, but prior to the completion and delivery hereunder. Such payment shall be made to us at or before the time when we are required to pay it.

(b) We agree to pay all contributions and taxes pursuant to any unemployment insurance, old age pension, or social security laws now in force, and you agree to pay, in addition to the stated purchase price, the amount of all increases in such contributions and taxes during the period from the date hereof and the completion of this agreement as shown by our records.

6. **Terms of Payment** — Payable in Current Canadian Funds.

(a) Terms of Payment will be Net 30 days from date of each invoice.

(b) Terms of Payment shall not be affected in any way should the Equipment be damaged or destroyed by fire, the elements or by any cause.

(c) The prices stated herein are based on labour rates and material costs as of the date of submitting this quotation. If labour rates or the costs of materials used in manufacture are increased or decreased, the price shall be adjusted appropriately.

(d) All provisions herein for additions to the purchase price are subject to any applicable legal limitations.

7. **Premium Time**

Our price is based on a straight time 8 hour day and 40 hour week. If it becomes necessary to pay premium rates for overtime, the price shall be increased to fully cover these rates including overhead and profit.

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1.	One (1) bucket elevator as described in the specification, FOB point of sale	$ 8,370.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ N/A
3.	Transportation to site	$ 270.00
	TOTAL	$ 8,640.00

NOTE: Optional Extra for Complete Shop Assembly .... $ 900.00

TOTAL .... $ 9,540.00

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name	Ward Ironworks Limited	
Vendor's Name	Ward Ironworks Limited	
Model and Type	Model "E" Centrifugar Discharge	
Casing size	305 x 559	mm
Total height	9340	mm
Discharge height	8528	mm
Shaft center distance	8350	mm
Inlet flange dimensions	227 x 305	mm
Discharge spout flange dimensions	227 x 305	mm
Belt material	7"wide P.V.C. rated 350lbs/inch	
Belt width	178	mm
Bucket material	A.R. Steel, 10 ga.	
Bucket type	Style "A"	
Elevator maximum capacity	12	m^3/h
Elevator motor		
- **Enclosure type**	T.E.F.C.	
- **Manufacturer**	W.E.G. or Equal	
- **Speed**	1800	rpm
- **Power output**	1.119	kW
- **Temperature rise**	40	°C
- **Frame size**	145T	

Elevator drive

-	Type	Torque Arm Reducer
-	Manufacturer	Dodge
-	Model	TDT-225 c/w Backstop
-	Speed ratio	15 to 1

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order	2	months

NOTE: 2 Weeks Engineering and Submission of
General Arrangement Drawings.
6 Weeks Manufacture.

8. **Performance Bonds**

If performance bonds are required, the price shall be increased by an amount equal to the premium for these bonds.

9. **Installation**

(a) All of the equipment specified herein shall be installed by you and at your expense.

(b) Should you desire and so request, we will make available to you the services of a competent person to superintend the installation and/or first operation of the equipment specified. You shall reimburse us therefore at the rate of $ 320.00 per day of 8 hours; double time for all time over 8 hours in a single day; double time for all hours spent on Saturdays, Sundays and recognized Holidays — plus actural board and expenses including transportation to and from location of work, travel time included. Payment for such service shall be made by you 10 days from date of invoice.

(c) This offer is independent of other provisions of this Proposal. Since the nominal per diem charge stated does not cover the cost of insuring against the risk and hazards against all claims and losses from injuries to persons, including your employees, and damage to property and fire lossed resulting from any act of such person while on your property. In order to protect your interests in this connection, you shall call to the attention of your insurance representatives your obligation hereunder and arrange with them for proper clearance by your insurance carriers.

(d) Before shipment, we will apply one coat of paint to all structural and plate work and will grease or oil all exposed finished machinery parts.

(e) We will supply only such safety devices as are specified herein, except that in the event additional safety devices are required by law we will, at your written request and at your expense, furnish them upon receipt of proper specifications.

10. **Insurance**

You agree, upon delivery of the equipment, to assume all loss resulting from fire, the elements, or any other cause, injuring or destroying the equipment, and to provide and maintain at your own expense, during the term of this contract and until payment therefore is completed in insurance companies approved by us, insurance protecting both of us against such loss, for the full amount of this contract, covering the equipment herein specified; such loss, if any shall be payable to both of us as our respective interests may appear.

11. **Equipment Guarantee**

We guarantee that the material and workmanship, entering into the construction of the equipment will be first-class of their kind for the purpose stated herein, which guarantee shall be binding upon us for a period of one year from and after shipment of all equipment and materials specified herein. If, at any time within said period, it is established to our satisfaction that any part or parts of our manufacture were defective at the time they were furnished, we will promptly repair such part or parts, if delivered F.O.B. our factory; or at our option, we will supply, F.O.B. our factory, replacement parts for such defective parts. We make no other warranties or guarantees, express or implied, and we are not to be held liable for loss, damage or expense of any nature arising from defective material, workmanship or parts. Damaged parts which are replaced become our property. Any parts which we do not manufacture are subject to the conditions imposed by our vendors. We will make no allowance for repairs, alterations, or other work done unless specifically agreed to in writing.

12. **Claims**

We will consider no claims for shortage or errors unless made immediately upon receipt of shipment.

13. **Changes and Delays**

(a) If you cause changes to be made or delay or interrupt the progress of the work or fail to furnish information facilities or apparatus as agreed herein, you will re-imburse us for any additional expense. Should it be established that any reduced cost results from such causes, we are to credit you for the amount.

(b) We are not to be held responsible for loss damage or delay due to fire, accidents, strikes, Government Action or other causes beyond our control.

(c) If you request delay in shipment of materials or equipment, the full purchase price of all work completed shall become due in 30 days.

14. **Patents**

We agree to hold you harmless against any liability for infringement of any apparatus claim of any Canadian Patent now issued, involving exclusively equipment actually sold and designed by us. You agree to hold us harmless against any liability for infringement of any apparatus claim of any Canadian patent now issued, involving equipment furnished by us in accordance with drawings or specifications furnished by you. It is mutually agreed that the party assuming liability shall be kept fully informed of any assertion of liability, and shall have the absolute right to dispose of such assertion of liability, including the right to settle, defend against suit, or make changes in the equipment to avoid infringement.

15. **Title**

(a) It is agreed that the equipment sold herein shall not be considered a fixture or incorporated into realty by reason of its attachment thereto, and title thereto shall remain in us, until complete payment therefore is made in cash. Payment shall be deemed complete when the full purchase price, including all notes given therefore, has been paid in cash.

(b) In the event of default in any payment herein provided for or actual or threatened imposition of a lien or adverse claim of any kind, the entire unpaid balance of the purchase price shall immediately become due and payable; and we may at our option repossess the equipment and all additions thereto, sever the same from realty or personalty for the purpose of repossession, and sell or dispose of the same at public or private sale and apply the proceeds towards the purchase price. All acts performed by us in such repossession, sale or disposal shall be free of legal liability to you.

(c) We shall have the right to assert our claim of a mechanic's lien against the property upon which the equipment is erected and to waive our rights under paragraphs (a) and (b) hereof.

(d) So far as permitted by law, the rights and remedies herein provided for are cumulative and not exclusive of any others available to us under the law. The failure to exercise any right or remedy on our part is not a waiver thereof nor any subsequent default.

16. **Time of Acceptance**

This proposal is void at our option unless your order is submitted within 30 days from the date hereof.

17. **Cancellation**

Cancellation or suspension of this order will be accepted only upon conditions which will indemnify Ward Ironworks Limited against loss.

18. **Execution**

There are no agreements or representations, oral or otherwise, outside of this Proposal; it shall become a binding contract only when accepted by an executive of Ward Ironworks Limited.

WARD IRONWORKS LIMITED

MSW/df

By ....

Maurice S. Ward, P.Eng.,
President.

Encl.: W-1811
Ward General

To: **Ward Iron Works Limited**

We hereby submit our order in accordance with the above Proposal.

Dated .... By ....

.... Title ....

Accepted at .... this .... day of ....

WARD IRONWORKS LIMITED

By ....

....

737

FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

QUOTATION

NO. 65EU123V PAGE 1 OF 2

DATE 1983 12 16

YOUR
☒ INQUIRY NO 0243-212-1
☐ LETTER OF
☐
☐

☐ PLEASE ADDRESS REPLY TO ABOVE
☒ OR 1-636 Clyde Ave, West Vancouver, BC V7T 1E1

TO INTEG - Intercontinental Engineering Ltd.
1155 West Pender Street
Vancouver, BC V6E 2P4

ATTENTION Mr. G.R. Cooper, P.Eng.

GENTLEMEN: We thank you for your inquiry and are pleased to submit the following for your consideration.

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
1	1	FMC/LINK-BELT type 141 centrifugal discharge bucket elevator, 26'-10" vertical centres, operating at 225 feet per minute, to handle 3.75 m^3/h of coal rejects and/or fluid coke, wood chips or peat. Buckets and belt: 6" x 4" cast nylon buckets, on 13" centres, mounted on a 2 ply Plylon 220 style B belt with 1/8" x 1/32" covers, 7" wide. Head terminal: 20" dia. x 8" wide crown face welded steel pulley with 3/8" thick vulcanized rubber lagging, mounted on a 1 15/16" dia. head shaft with ball bearing pillow blocks, shaft speed 45 rpm. Foot terminal: 16" dia. x 8" wide wing type, self cleaning pulley, mounted on a 1 1/2" dia. foot shaft with	1362 kg		$ 11,970.00	12 weeks	710

Terms apply to this and subsequent pages and are NET 30 DAYS F.O.B. Ottawa, Ont. Freight is extra. Federal and Provincial sales taxes are extra if applicable. Listed estimated shipping times are effective after receipt of an order. Prices are valid for a period of 30 days from date of this quotation and are subject to review if an order is delayed beyond this time. Please refer to general terms and conditions of sale listed on the back of this page.

FMC of Canada Limited
Material Handling Equipment Division

AREA MANAGER J.W. (Bill) Potma

PER

212-1

FMC FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-98629C

PAGE 2 of 2 OF QUOTATION 65EU123V DATED 8[illegible] 12 16

TO INTEG

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
		ball bearings mounted in an internal gravity take-up. Casing: 11 3/4" x 35" mild steel casing, consisting of - 12 guage head section with style 2 discharge spout with abrasion resistant steel spout liner. - 14 guage hood. - 12 guage intermediate sections. - 7 guage boot section with stub inlet with special horizontal flanged inlet connection with removable cover plate. Drive: Link-Belt 107D24 shaft mounted speed reducer with integral backstop, V-belt drive and a 1 hp motor, class II group F Division I explosion-proof, TEFC, 575/3/60. Finish: Exterior surfaces of carbon steel fabrication will be FMC standard shop prime coat painted. Note: Feed to elevator must be controlled by others to provide uniform and continuous feed. Items not included: Motor controls, bracing, connecting chutes and spouts, service platform or ladder, erection or field service. Delivery: 12 weeks from approval of drawings. Drawings for approval can be submitted in 3 weeks from receipt of order.					

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR

1.	One (1) bucket elevator as described in the specification, FOB point of sale	$ 11,970.00 FOB Ottawa
2.	Canadian Customs Duty (where applicable) 11.4 % of $ 8,481.00	$ 967.00 (included)
3.	Transportation to site	$ 1,040.00 (included)
	TOTAL	$ 11,970.00

SCHEDULE II - TECHNICAL DATA

BUCKET ELEVATOR

1.0 SPECIFICATIONS

Manufacturer's Name	FMC/LINK-BELT	
Vendor's Name	FMC of Canada Limited	
Model and Type	type 141 bucket elevator	
Casing size	298 x 889	mm
Total height	9328	mm
Discharge height	7823	mm
Shaft center distance	8179	mm
Inlet flange dimensions	152 x 305	mm
Discharge spout flange dimensions	302 x 330	mm
Belt material	220 Plylon style B	
Belt width	178	mm
Bucket material	cast nylon	
Bucket type	similar to type AA	
Elevator maximum capacity	7.93	m^3/h
Elevator motor		
- Enclosure type	TEFC class II group F division 1	
- Manufacturer	Westinghouse or equal	
- Speed	1745	rpm
- Power output	.746	kW
- Temperature rise	125	°C
- Frame size	143T	

FMC of Canada Limited
1983 12 16

Elevator drive

- Type: Shaft mounted reducer & V-belt
- Manufacturer: LINK-BELT (PTC) & Dodge
- Model: 107D24
- Speed ratio: 24:1

2.0 LIST OF ALTERNATIVES AND EXTRAS

none

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order and after receipt of approved drawings 3 months

Time required to submit approval drawings 1 month

221-1

LIMESTONE STORAGE AND METERING SYSTEM

BIDDER'S LIST

LIMESTONE HANDLING SYSTEM (221-1)

F. Drexel Western Ltd.
4084 McConnell Court
Burnaby, B.C.
V5A 3N7

Attention: Mr. Ray Mathieson

Merrick Canada Ltd.
494 The Queensway
Peterborough, Ontario
K9J 7L9

Attention: Mr. D.E. Lewis, P. Eng.

J & M Industrial Supply Ltd.
2899 Steeles Ave. W, Unit No. 4
Downsview, Ont.
M3J 9Z9

Attention: Mr. D. Robertson

Armstrong Jones Ltd.
83 Sunrise Ave.
Toronto, Ont.
M4A 1B1

drexel

F. DREXEL WESTERN LTD.

☒ **BURNABY**, B.C. V5A 3N7
4084 McCONNELL COURT.
PHONE (604) 420-2443 TELEX 04-354852

☐ **PRINCE GEORGE**, B.C. V2N 1X5
1846 QUINN STREET
PHONE (604) 563-0179 TELEX 047-8612

☐ **EDMONTON**, ALBERTA T5B 4J7
6720 SANTA ROSA RD.
PHONE (403) 471-4301 TELEX 037-2629

☐

221
(BROCHURES)

integ
NOV 29 1983
G.C.

TO
Intercontinental Engineering Ltd.,
7th Floor, 1155 West Pender Street
VANCOUVER, B.C.
V6E 2P6

ATTENTION Grant Cooper
REFERENCE Project 0243, Inquiry No. 221-1
QUOTATION NO. #W49138
DATE November 28th, 1983

ITEM	QUANTITY	SIZE	DESCRIPTION	UNIT PRICE
1.	1		LIMESTONE METERING SYSTEM K-TRON model LWF-3/200 LOSS-IN-WEIGHT metering system, complete as follows: S-200 screw-type agitated feeder with 45 mm solid-flight screw 2.5 ft.^{3} (0.07 m^3) closed-top hopper Digital controller - including 4 relays - for feeder running, refill request, refill not complete, alarm (for hi/lo feedrate or speed, or scale disturbance) Remote totalizer, start/stop switch, run light, under/over feed indicators, auto/manual status indicator Automatic hopper inlet slide gate Outlet sampling and diverter valve Outlet manual slide gate valve 4-20 mA output signal, proportional to mass flow PAGE 1/1 ..../2 - ? NOT INCLUDED	$ 39,920.00

Calgary-Edmonton-Lethbridge-Prince George-Regina-Saskatoon-Vancouver-Victoria

F.O.B. POINT: as per attached
DELIVERY: as per attached
TERMS: NET 30 DAYS
ALL TAXES EXTRA

APPROVED BY: Mike Patti

PREPARED BY: Ray Mathieson

ZZ1-1

MERRICK

(SEE MERRIC PROPOSAL
FOR FUEL SYSTEM Z11-1)

Proposal

(BROCHURES)

INTEG - International Engineering Limited

Proposal: A-34307

Item No.	Quantity	Description	Price
		LIMESTONE STORAGE AND METERING SYSTEM	
6:0	1	12" MERRICK MODEL 951 DSC-1 WEIGHER Engineered and Designed to the following requirements. Material: Crushed Limestone Capacity: 0.012 Kg/S Density: 1600 Kg/M^3 Size: - 6 mm Moisture: Dry Temperature: Ambient Indoors Drive: A.C. Prefeeder: Screw ~~Rotary Airlock~~ Feeder w/SCR DC Drive Power Required: 115 VAC/1/60 STANDARD EQUIPMENT: A. Self-contained Belt Weigher, Including: 1. Cantilever CRS Feeder frame designed to permit quick replacement of feeder belt and complete removal of the feeder for maintenance. Frame is supported by 304 SS support rods. 2. Crowned aluminum conveyor head and tail pulleys. 3. Belt - precision woven endless, polyester, black neoprene coated, rated at 250°F (120°C) 4. 304 SS Slider bed support decks. 5. 304 SS full length skirtboards designed for quick removal. 6. 304 SS infeed with insert (square). 7. 304 SS shear gate - manually adjusted. 8. 304 SS feed cutoff gate (manual slide gate valve) 9. 304 SS metal blade scrapers at belt discharge, inside belt and tail pulley.	

Item No.	Quantity	Description	Price
		B. Weight Transducer System, Including: 1. Precision milled aluminum weighdeck. 2. Precision strain gauge load cell with overload protection. C. Speed Pickup: DSP-3 solid state digital sensor mounted in an explosion proof housing, driven off drive motor. D. Motor: Model 951 Constant speed 1/4 H.P. AC Induction Motor, explosion proof, Class I, Division I, Group D; Class II, Division I, Groups F & G; 115V/1/60 Hz including suitable reducer, right angle drive, couplings and guards. E. Test Chain - For calibration F. DSC-1 Digital Feed Control System 1. 4 digit thumbwheel switch for setting rate. 2. "High" and "low" alarm contacts and lights. 3. Proportional band and reset adjustment. 4. 0-5 MA DC controller correction output signal. 5. 4 digit L.E.D. digital "rate", "weight" and "speed" display. 6. 8 digit L.E.D. totalizer - resettable. 7. Analog "rate" output signal. 8. Digital output signals. 9. Panel mount or wall mount enclosure.	

Item No.	Quantity	Description	Price

G. EQUIPMENT SUPPLIED BY OTHERS:

1. AC motor starter.
2. "Power" disconnects.
3. Supports other than specified.
4. Wiring between remote and local instruments.
5. Stepdown transformers or isolation converters.

H. SPECIAL EQUIPMENT

1. Standard Enclosure with easy clean cantilevered Stringer Assembly, 304 SS Construction, except Carbon Steel door and enamel exterior (Merrick blue-green). Includes removeable side door with full length clear plastic window and quick removal handles.
2. Sampling Chute, Carbon Steel Construction with manually operated gate.
3. Local Control Station in EEMAC 12 Enclosure Includes:
   a) Hand-Off-Auto Selector Switch.
   b) Start and Stop Buttons
   c) 3-1/2 digit L.E.D. digital "rate" display.
   d) Potentiometer Setpoint Selector.

ACCURACY:

The Model 951 DS GRAVIMERIK is guaranteed to weigh with an accuracy of plus or minus 0.5% of full scale when installed in accordance with Merrick's recommendations and instructions.

DRL

748

MERRICK

Proposal

INTEG - International Engineering Limited

Proposal: A-34307

Page 10

Item No.	Quantity	Description	Price
7:0	1	MERRICK STORAGE HOPPER Designed and Engineered to the following Specifications: A. Storage Capacity of 35 Cu. Ft. B. Constructed of 3/16" Thick Mild Steel, 3'0" Diameter Flanged Inlet x 4'0" Straight Side Height with 60 Degree Conical Section to 6" Flanged Outlet. C. Half-Coupling Fittings for High and Low Level Indicators. D. Flanged Sampling Port, 2" diameter complete with Mild Steel Manual Slide Gate Valve. E. Bin Cover, Mild Steel Construction, 3/16" Thick with following features. 1) Main Material Inlet, 6" diameter, Flanged, complete with Manual, Mild Steel Slide Gate. 2) Auxiliary Material Inlet/Inspection Port, 10" diameter, Flanged, complete with cover w/ Handle and two (2) Quick Clamp Fasteners. F. Four (4) Integral Support Legs, 2" x 2" Angle, Stitch Welded to Bin Body with Bottom Plate Flanges, drilled for Anchor Bolts(By Others).	
8:0	2	LEVEL INDICATOR, Refer to Item 4:0	
9:0	1	MERRICK MODEL MCF1900-B SCREW PREFEEDER Designed and Engineered to the following Specifications: A. Integral Hopper and Feeding Chamber, 3/16" Thick Mild Steel. B. Precision machined, Stainless Steel, Solid Flight Feeding Screw and Discharge Cylinder and Downspout Assembly.	

Item No.	Quantity	Description	Price
		NOTE: Double Flighting Provide on Feeding Screw. C. Flanged Mild Steel Cover w/ Circular Inlet. D. Material Conditioning Hopper with Conditioning Auger. E. 1/2 H.P. D.C. Motor directly coupled to drive shaft, including suitable reducer, couplings, guards and FSC-4C motor speed controller (SCR) mounted in separate NEMA 12 Enclosure.	
0:0	1	ROTARY AIRLOCK FEEDER, MODEL VB6 x 8 Designed and Engineered to the following Specifications: A. Cast Iron End Plates, Steel Rotor and Body. B. Precision machined. C. Drop through Design. D. 6 inch Square Inlet and Outlet. E. Inboard Bearings and Double Lip Seals. F. A.C. Gear Motor Drive complete with Chain Drive and Guard.	
		TOTAL PRICE ONE (1) LIMESTONE STORAGE AND FEEDING SYSTEM, COMPLETE AS DESCRIBED, ITEMS 6 THROUGH 10	$27,579.00
11:0	1	24" VIBRANETICS MODEL BD-2 BIN DISCHARGER Designed and Engineered to the following Specifications: A. SHELL 1/8 thick, Mild steel, 24" inlet diameter, 9" outlet diameter, 45 slope B. DRIVE 1.0 H.P. (TEFC) 575 Volts, 1 Phase, 60 HZ	

Item No.	Quantity	Description	Price
		C. CYCLE TIMER - Will be provided with a cycle timer.	
		D. ISOLATION - Unit will be supplied with Vibranetics forged steel hanger arms with rubber isolators for support from above.	
		E. STROKE AND FREQUENCY - 1/8 @ 1750 C.P.M.	
		F. FLEXIBLE SEALS - Bolted inlet sock with inlet skirt and outlet sock will be provided with the unit constructed of Black E D P M material w/ 2 304SS Drawbands. Inlet sealing complete with Restraining Bolting Bars for Vacuum Service.	
		G. FINISH - (INSIDE) - WELDS CLEANED, NO PAINT. FINISH - (OUTSIDE)- SANDBLAST AND ENAMEL	
		H. INSPECTION & ASSEMBLY - Unit will be completely shop assembled and inspected prior to shipment.	
		TOTAL PRICE ONE (1) LIMESTONE STORAGE AND FEEDING SYSTEM, COMPLETE AS DESCRIBED, ITEMS 6 THROUGH 11	$30,437.00
		....	
		Engineering Notes:	
		1) All prices are in Canadian Funds, F.O.B. Peterborough, Ontario and are exclusive of all applicable taxes.	
		2) Drawings: 3 to 5 Weeks after an order and complete data. Equipment 9 - 11 Weeks after approved drawings	

Item No.	Quantity	Description	Price
		Engineering Notes: (Cont'd) 3) The Coal and Limestone Feed control systems may operate in a master/slave control loop (ratio basis) or the DSC-1 will accept an external demand signal, or each system may be operated independently from integral digital set point selector. 4) Estimated Shipping costs are shown separately and will be billed at actual costs. 5) Installation & Calibration Per the attached Form. 6) Referring to Item 6.17 of the Fuel System and Item 6.21 of the Limestone System Specification, the external trip input signal lead(s) would preferably be wired to the terminal blocks provided on the Model FSC-4 SCR Controller. In the event of an interrupt, power would be maintained to the Model DSC-1 Control to facilitate retention of totalized weight throughput, while actual Feeder operation would be stopped.	

SCHEDULE I - SCHEDULE OF PRICES

LIMESTONE HANDLING SYSTEM

1.	One (1) limestone handling system as described in the specification, FOB point of sale	$ 27,579.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site (Estimated)	$ 450.00
	TOTAL	$ 28,029.00

SCHEDULE II - TECHNICAL DATA

LIMESTONE HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name	Merrick Canada Limited	
Vendor's Name	Merrick Canada Limited	
Weighfeeder Model and Type	Model 951-DSC-1 Weigh Belt	
Rotary Valve Model and Type	Model VB8 x 6	
System total dimensions	950 x 1400 x 3550	mm
System total weight	1200	kg
Bin height	900	mm
Bin diameter	900	mm
Bin lining or coating	Not Required	
Rotary valve flows		
- Minimum	0.014	kg/s
- Maximum	0.014	kg/s
Weighfeeder belt width	305	mm
Weighfeeder flows		
- Minimum	0.0007	kg/s
- Maximum	0.014	kg/s
Weighfeeder outlet connection dimensions	228 x 356	mm
Rotary valve drive		
- Type	Right Angle Gear Reducer	
- Manufacturer	Dodge	
- Model	"Tigear"	
- Speed Ratio	32.0:1	

Power supply requirements	575 **VA** 60 **V** 3 **phase**
Rotary valve motor	
- **Enclosure type**	TEFC
- **Manufacturer**	Westinghouse
- **Power output**	0.75 **kW**
- **Temperature rise**	40 **°C**
- **Speed**	1750 **rpm**
- **Frame size**	143T
Weighfeeder drive	
- **Type**	AC
- **Manufacturer**	Merrick
- **Model**	DSC-1
- **Speed ratio**	20:1
- **Power supply requirements**	575 **VA** 60 **V** 3 **phase**
Weighfeeder motor	
- **Enclosure type**	TEFC
- **Manufacturer**	GE or equal
- **Power output**	0.2 **kW**
- **Temperature rise**	40 **°C**
- **Speed**	1750 **rpm**
- **Frame size**	56C
Control power requirements	
- **Weighfeeder**	115 **VA** 60 **V** 3 **phase**

2.0 LIST OF ALTERNATIVES AND EXTRAS

Merrick Model MCF1900 Screw Prefeeder

Vibranetics Model BD-2 Vibrating Bin Discharger

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order ____4____ months

221-1

J & M INDUSTRIAL SUPPLY LIMITED

J & M

2899 STEELES AVE. W., UNIT 4
DOWNSVIEW, ONTARIO M3J 3A1
TEL: (416) 665-2300 TELEX: 06-217758

(BROCHURES)

PROPOSAL TO:	Intercontinental Engineering Ltd., Attn.: Mr. G. R. Cooper, P. Eng., Project Manager, 1155 West Pender St., Vancouver, B.C., V6E 2P4	Date Quotation No. Your Inquiry No. Reference:	Dec. 21/83 83-03-11-2072 221-1 Limestone Storage and Metering System.

EM O	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		Dear Gentlemen:		
		We thank you for your request dated Oct. 21/83 and are pleased to submit our quotation as follows:		
1.	1	Wallace & Tiernan Model 31-160 RC Rotary Inlet Speed Control Digital Weighbelt Feeder as detailed in attached Catalogue file 310.160 and dwg. 311.417. Basic feeder is dust tight and is suitable for general purpose applications. Electrical enclosures exceed NEMA 12 standards. Feeder will be painted green and supplied complete with Digital Controller (mounted on inlet end of feeder), single speed gear box, SCR drive, test weight, 316 s.s. side rails, coupling guard, standard belt, 4 rubber shock mounts, 1 gallon of oil, 6 sets of instructions, 1/4 hp TENV DC permanent magnet type motor, air purge fitting, inlet flexible connection and a manual outlet sampling valve. Feeder will have a 4-20 mA output capability and also be able to be controlled from a 4-20 mA input signal.		
2.	1	Remote control to be mounted by others in the owner's control panel. Controller to be complete with Digital Mass Flow Indicator, start/stop switch with front light, under/over feed alarm indicators.		
3.	1	Fabricated holding hopper of 10 ga. (.1345 thk.) carbon steel, approx. 3 ft. dia. with 3 ft. straight section with 60 deg. cone section to 8" flanged discharge outlet and a closed head. The unit shall be of all welded construction and shall be complete with; air purge fitting, 6" flanged inlet spout, 10" dia. flanged inspection port (gasketted and complete with hinge and latch), 2 " dia. sampling port, two 2" dia. couplings (plugged) in cone section, two 4" channel base mounts on cone for use with vibrator, two		

Terms: Net 30 days, Taxes Extra. Prices Firm for 30 Days.

F

J & M INDUSTRIAL SUPPLY LIMITED

Delivery: weeks from receipt of written purchase order, approved drawings (if required), and all engineering details.

NOTES:
- Manufacturers' Standard Warranty Only Applies.
- 1 Set Instructions included; additional available at current price.
- Start-Up Service not included but available if required, at current service rates plus mileage and expenses.

Continued on page 2

J & M INDUSTRIAL SUPPLY LIMITED

2899 STEELES AVE. W., UNIT 4
DOWNSVIEW, ONTARIO M3J 3A1
TEL: (416) 665-2300 TELEX: 06-217758

Date	Dec. 21/83
Quotation No.	83-03-11-2072
Your Inquiry No.	221-1
Reference:	

PROPOSAL TO: Intercontinental Engineering Ltd.,
Attn.: Mr. G. R. Cooper, P. Eng.,
Project Manager

EM O.	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		openings for level controls, one 3" flanged exhaust vent, The hopper shall have four 4" angle iron support legs c/w foot pads and shall be wire brushed inside and out, with shop primer applied outside.		
4.	1	Hopper accessories including; two Model RA-1 rotating paddel type level controls (110/1/60 TEFC), one fabricated steel manual slide gate valve with handwheel operator for mounting on product inlet, one fabricated steel exhaust filter can with replaceable filter cartridge (99.9% efficient) and complete with 3" manual BF valve for sealing of hopper,one 2" dia. sample port shut off valve with hand level operator, one Model 30S electric vibrator for mounting on cone section 110/1/60.		
5.	1	Manual slide gate valve 8" size of fabricated steel construction with handwheel operator for control of discharge, and complete with one fabricated steel square to square fabricated transition piece to match the slide gate valve to the rotary feeder		
		TOTAL ESTIMATING PRICE Items 1 - 5		$ 33,500.00
		Note: The flexible connection would be installed above the rotary valve. The only warranty which shall apply will be the manufacturers standard which generally is 12 months from the date of shipment.		
		We have enclosed the revised copy of the Limestone Storage and Feed general arrangement dwg. and your schedule 1 & 2.		
		If you have any questions regarding the above, please do		

Terms: Net 30 days, Taxes Extra. Prices Firm for 30 Days.

F

Delivery: weeks from receipt of written purchase order, approved drawings (if required), and all engineering details.

NOTES:
- Manufacturers' Standard Warranty Only Applies.
- 1 Set Instructions included; additional available at current price.
- Start-Up Service not included but available if required, at current service rates plus mileage and expenses.

J & M INDUSTRIAL SUPPLY LIMITED

Continued on page 3

Date Dec. 21/83
Quotation No. 83-03-11-2072
Your Inquiry No. 221-1
Reference:

PROPOSAL TO: Intercontinental Engineering Ltd.,
Attn.: Mr. G.R. Cooper, P. Eng.,
Project Manager

EM O.	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
		not hesitate to contact either myself or Mr. Duncan Robertson. hk		

Terms: Net 30 days. Taxes Extra. Prices Firm for 30 Days.
F shipping point
Delivery: 14 weeks from receipt of written purchase order, approved drawings (if required), and all engineering details.

NOTES:
- Manufacturers' Standard Warranty Only Applies.
- 1 Set Instructions included; additional available at current price.
- Start-Up Service not Included but available if required, at current service rates plus mileage and expenses.

J & M INDUSTRIAL SUPPLY LIMITED

B FitzGerald

B. FitzGerald,
Inside Sales

SCHEDULE I - SCHEDULE OF PRICES

LIMESTONE HANDLING SYSTEM

1.	One (1) limestone handling system as described in the specification, FOB point of ~~sale~~ shipping	$ 33,500.00
2.	Canadian Customs Duty (where applicable) ____ % of $ ________	$ ________
3.	Transportation to site	$ 350.00
	TOTAL	$ 33,850.00

SCHEDULE II - TECHNICAL DATA

LIMESTONE HANDLING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name		
Vendor's Name	J + M INDUSTRIAL SUPPLY LTD.	
Weighfeeder Model and Type	31160 RC Rotary Inlet Speed Control Digital Weighbelt Feeder	
Rotary Valve Model and Type		
System total dimensions		mm
System total weight		kg
Bin height		mm
Bin diameter	900	mm
Bin lining or coating	none	
Rotary valve flows		
- Minimum	0.009	kg/s
- Maximum	7.27	kg/s
Weighfeeder belt width	2.25	mm
Weighfeeder flows		
- Minimum	0.009	kg/s x min.
- Maximum	7.27	kg/s
Weighfeeder outlet connection dimensions	19.7 x 35.3	mm
Rotary valve drive		
- Type	DC motor	
- Manufacturer	Integral part of feeder	
- Model		
- Speed Ratio		

Power supply requirements ______ VA _____ V ____ phase

Rotary valve motor

- Enclosure type ____________________
- Manufacturer ____________________
- Power output ____________ kW
- Temperature rise ____________ °C
- Speed ____________ rpm
- Frame size ____________

Weighfeeder drive

- Type ____________________
- Manufacturer ____________________
- Model ____________________
- Speed ratio ____________
- Power supply requirements ______ VA _____ V ____ phase

Weighfeeder motor

- Enclosure type ____________________
- Manufacturer ____________________
- Power output ____________ kW
- Temperature rise ____________ °C
- Speed ____________ rpm
- Frame size ____________

Control power requirements ____________

- Weighfeeder ______ VA _____ V ____ phase

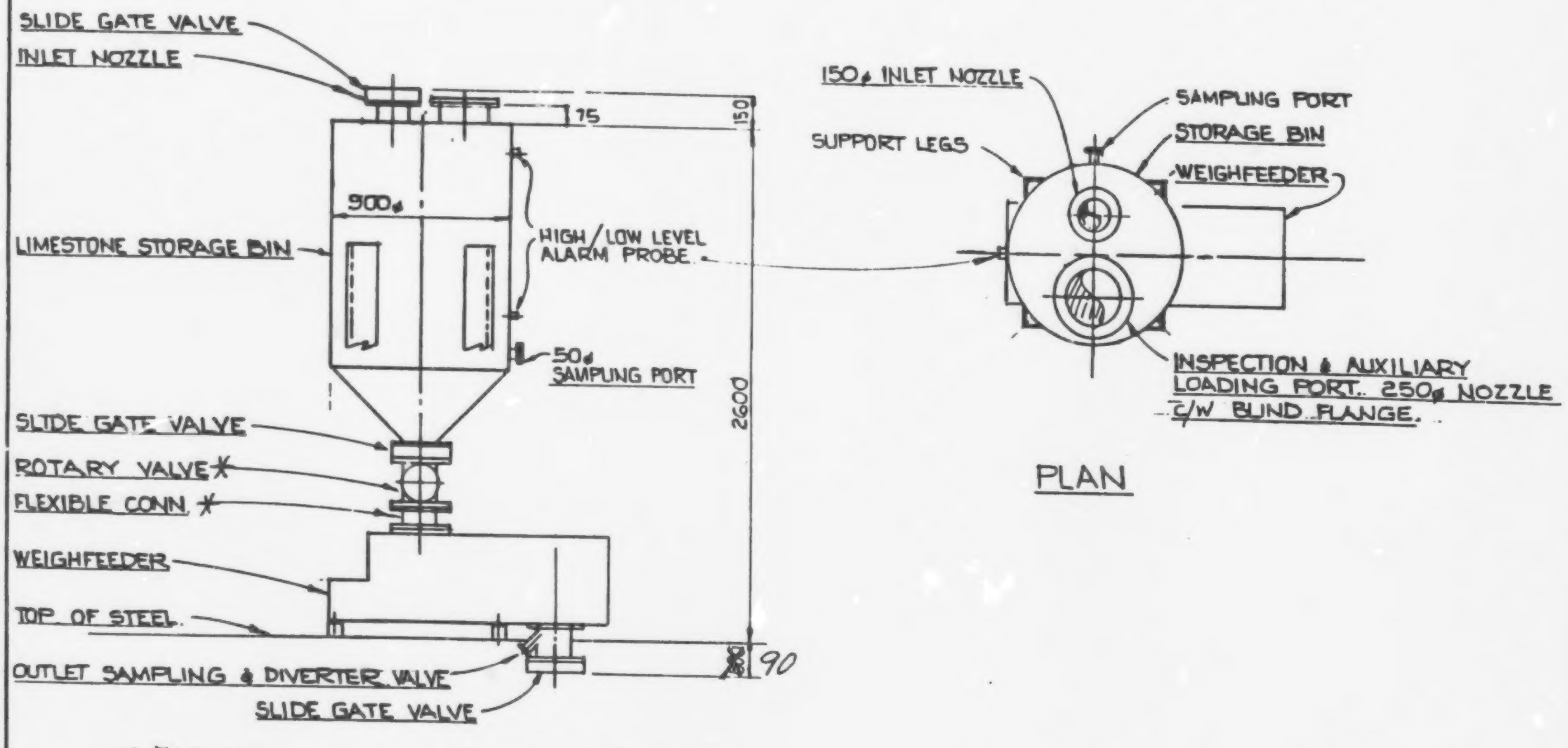
Feeder power requirements motors and controls 6.5 amperes, 115v, 1 phase

2.0 LIST OF ALTERNATIVES AND EXTRAS

An exhaust vent and filter has been included on hopper.
All hoppering equipment shall be shop primed outside and feeder shall be painted green.

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order approved dwgs and all engineering details. 3.3 months


SLIDE GATE VALVE
INLET NOZZLE
LIMESTONE STORAGE BIN
SLIDE GATE VALVE
ROTARY VALVE *
FLEXIBLE CONN *
WEIGHFEEDER
TOP OF STEEL
OUTLET SAMPLING & DIVERTER VALVE
SLIDE GATE VALVE
900ø
75
150
2600
90
HIGH/LOW LEVEL ALARM PROBE
50ø SAMPLING PORT
150ø INLET NOZZLE
SUPPORT LEGS
SAMPLING PORT
STORAGE BIN
WEIGHFEEDER
INSPECTION & AUXILIARY LOADING PORT. 250ø NOZZLE C/W BLIND FLANGE.
PLAN

*FLEXIBE CONN WILL BE ABOVE ROTARV VALVE

Design	Drawn	Check	Appd	Issued for	Date	Rev
	L.R.					

ENERGY MINES & RESOURCES.
CANADA

integ

LIMESTONE STORAGE & FEED
GENERAL ARRANGEMENT

B 0243 SK 221-1 0

222-1

PNEUMATIC CONVEYING SYSTEM

BIDDER'S LIST

PNEUMATIC CONVEYING SYSTEM (222-1)

Ducon-Mikropul Ltd.
1940 Steeles Ave., East
Bramalea, Ontario
L6T 1A7

Firing Industries Ltd.
60 Picton St.
P.O. Box 230
Niagara-on-the-Lake, Ontario
LOS 1JO

Attn: Mr. Dan Feasby, P. Eng.

222-1
(BROCHURES)

DUCON-MIKROPUL LIMITED

1840 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

November 18, 1983.

Integ International Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

Attention: Mr. G.R. Cooper, P. Eng.,
Project Manager

Gentlemen:

Subject: Energy Mines & Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
File: 0243-El
Ducon-Mikropul Proposal: S-5882
For Limestone Pneumatic Conveying System

Thank you for your inquiry 0243-El covering the subject requirement.

As advised, we are pleased to enclose our Ducon-Mikropul Proposal S-5882 for a Pneumatic Conveying System for limestone.

We have designed a dilute phase vacuum conveying system based on your specification and every effort has been made to meet all your requirements.

Bulletins and sketches are enclosed in order to assist you in evaluating our proposal.

We now look forward to discussing our proposal in more detail with you and to working with you to a successful completion of this project.

Should you have any questions, please do not hesitate to call the undersigned or our Vancouver Representative, Mr. Bill Massey - Telephone: (604) 299-8808.

Yours very truly,
DUCON-MIKROPUL LIMITED.

Swapan Mitra
Engineering Sales.

Enclosures.

cc: Mr. Bill Massey
Beckland Equipment Ltd.

/jv

DUCON-MIKROPUL LIMITED

Integ International Engineering Ltd.,
November 18, 1983

Page 1 of 2
Ducon-Mikropul Proposal: S5882

EQUIPMENT SPECIFICATION

One (1) only — Vacuum Pneumatic Conveying System designed to handle dry limestone at the rate of .2 Kg/S (per spec.) comprising of the following items:-

Item #1: Blower Package:

One (1) only — Rotary Positive Blower Package, Model: Roleus RVT-60 complete with the following items:-

- Elevated base.
- 2" Vacuum relief valve.
- 4" Inline filter.
- 4" Discharge silencer.
- 7.5 H.P., T.E.F.C. 575V/3 Ph/60 Hz. motor.
- V-belt drive.
- O.H.S.A. drive guard.
- Vacuum gauge.
- Interconnecting piping.
- Shipped assembled.
  See bulletins enclosed.

Item #2: Cyclone:

One (1) only — Ducon-Mikropul Cyclone Model: CR-24 made out of 10 ga. C.S. complete with flanged inlet, outlet and discharge and deep leg.

- Shipped assembled.
  See Sketch enclosed.

Item #3: Rotary Airlock:

One (1) only — Ducon-Mikropul 6" Perma/flo type B rotary airlock of cast iron construction with adjustable Permalloy (550 Brinell) rotor and shoe. Unit features outboard bearings, air purge hubs, packing lgand seals, over sized rotor shaft, 1/2 H.P., T.E.F.C. 565V/3 Ph./ 60 Hz. motor with gear reducer unit, chain and sprockets and O.H.S.A. guard.

- Shipped assembled.
  See bulletin 4300.

Item #4:	Other Fittings:
One (1) only	Lot System Fittings, complete with the following items:-

- 3" Diameter, 17'-0" long heavy duty flexible hose.
- Transition pieces as required.
- Material pick-up tee.
- Manual butterfly damper 3" size.

The following items are not included:-

- Installation.
- Control panel.
- Conveying and clean air pipes and fittings.
- Motors, starters.

Our price is based on:-

- F.O.B. Point of Manufacture.
- All taxes extra.
- Delivery eight (8) to ten (10) weeks after approval.
- Terms net thirty (30) days.
- Valid until December 30th, 1983.

DUCON-MIKROPUL LIMITED

SCHEDULE I - SCHEDULE OF PRICES

PNEUMATIC CONVEYING SYSTEM

1.	One (1) pneumatic conveying system as described in the specification, FOB point of sale	$ 16,040.00	
2.	Canadian Customs Duty (where applicable) _____ % of $ ___________	$ N/A	
3.	Transportation to site	$ 600.00	(ESTIMATED)
	TOTAL	$ 16,640.00	

DUCON-MIKROPUL LIMITED

SCHEDULE II - TECHNICAL DATA

PNEUMATIC CONVEYING SYSTEM

1.0 SPECIFICATIONS

Manufacturer's Name	DUCON-MIKROPUL LIMITED	
Vendor's Name	DUCON-MIKROPUL LIMITED	
Blower Model and Type	ROBUS RVT-60	
Filter/Separator Model and Type	CR-24	
Rotary Airlock Model and Type	6" PERMA/FLO TYPE B	
Weight of blower package	444	kg
Weight of separator & rotary airlock	400	kg
Height of separator & rotary airlock	PER BULLETIN & SKETCH	mm
Rotary airlock flange size	" " "	mm
Maximum conveyor capacity	.2	kg/s
Blower motor		
- Type	T.E.F.C. (575V/3PH/60Hz)	
- Manufacturer	LINCOLN OR EQUIVALENT	
- Output	7.35	kW
- Speed	1750	rpm
- Temperature rise	N/A	°C
- Frame size	215T	
Blower data		
- Volumetric flow	.18	m^3/s
- Speed	2280	rpm
- Size of suction connection	100	mm
- Size of discharge connection	100	mm

- Vacuum (-) 24 kPa(g)
- Maximum noise level 93 dBA
- Silencer Type ABSORBTIVE

Rotary airlock motor

- Enclosure type T.E.F.C.
- Manufacturer LEESON ELECTRIC OR EQUIVALENT
- Output .36 kW
- Speed 1750 rpm
- Temperature rise N/A °C
- Frame size

Rotary airlock drive

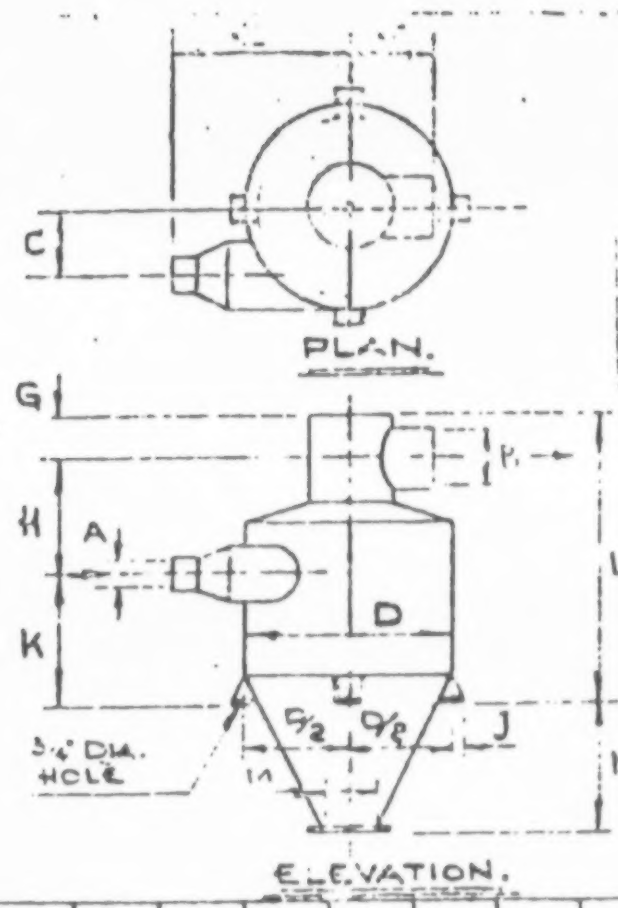
- Type CHAIN AND SPROCKETS THROUGH GEAR REDUCER UNIT
- Manufacturer DUCON-MIKROPUL LIMITED /LEESON ELECTRIC
- Speed ratio 90:1

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 2 - 2-1/2 months

1981


C
PLAN.
G
B
H
A
L
D
K
D/2
D/2
J
3/4" DIA. HOLE
M
N
ELEVATION.

D SIZE	A DIA	B DIA.	C	E	F	G	H	J	K	L
24	3 3½ 4	6	8¾	22	10	5	11	1¼	14	30
36	5 6	8	13¾	28	12	5½	17	1¼	21½	44
48	7 8	10	18⅝	33	18	7	20½	1½	25	52½
60	10	12	23⅝	40	21	9	24	1½	28	61

SIZE	M DIA.	N
24	6	20
	8	17
36	8	33
	10	30
48	10	45½
	12	42½
60	14	58

REV	BY	DATE	DESCRIPTION
B	FJP	[illegible]	UP-DATED

THE DUCON COMPANY INC.

TYPE CR CYCLONES
FOR PNEUMATIC CONVEYING APPLICATIONS

DR BY W.C. MARTI
SCALE N.T.S.
C-50-5
REV B

CONDITIONS OF SALE AND WARRANTY

GENERAL:

A) All purchase orders are subject to acceptance by the home office of Ducon-Mikropul Ltd. as evidenced by a signed acknowledgement which will be forwarded to the purchaser.

B) The contract is entered into at the factory of the seller in Bramalea where the order based hereon is accepted. The entering into, construction, interpretation, performance and discharge of this contract will be governed by the laws of Ontario.

C) In case performance hereunder by the Company shall be delayed or rendered impossible by force majeure, including war, governmental authority, embargoes, prohibition of or restriction on exports or imports, civil commotions, labor difficulties, accidents, loss or damage by act of God or the elements, intereferences with transportation, closing or interruption of customary short routes of transportation or any other contingency beyond the Company's control and whether herein specifically enumerated or not in the connection with the production or transportation of the equipment which is the subject of this order expected arrival shall be extended for a period equal to the duration of the contingency and for a sufficient time thereafter in which to make shipment. The Company shall in no event be held responsible for any contingency beyond its control whether herein specifically provided for or not.

PAYMENT AND SALES TAX:

A) Prices to not include any present or future local, provincial or federal excise, sale privilege or uses taxes. The amount of such taxes will be added to the sales price if the Company is required to pay them.

B) Title to the equipment shall pass to the purchaser upon delivery to the carrier.

C) Prorata payments will become due as shipment is made. If shipments are delayed by the purchaser, payment shall become due on the date the Company is prepared to make shipment. Equipment held for the purchaser shall be at the risk and expense of the purchaser.

D) In the event the purchaser defaults on any payment, or in the event the financial responsibility of the purchaser becomes impaired or unsatisfactory to the Company, the full amount of all payments required hereunder which are unpaid shall, at the election of the Company, become immediately due and payable. Upon default of the purchaser in complying with the terms of the payment hereof, the Company may take immediate possession of any equipment delivered to the purchaser pursuant to the within purchase order without legal process, without demand and for this purpose the Company may enter any premises where said equipment may be found and remove same.

CANCELLATION:

Cancellation of orders accepted by the Company can be made only with the Company's consent. The purchaser shall pay the full purchase price for all items completed. On such items that are not completed, a charge will be made for materials used and labor costs together with sales engineering and administrative overhead plus profit as per the original purchase order. A minimum charge of 10% of purchase price for cancellation will apply.

WARRANTY:

A) Materials:

The Company warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in material and workmanship under normal use and service for twelve (12) months after shipment (except filter tubes - ninety (90) days). This warranty does not cover products, accessories, parts of attachments which are not manufactured by the Company and shall receive only such warranty, if any, as given by the manufacturer thereof. Warranty does not apply where undue wear or breakage is caused by careless or improper handling or where defects are remedied by others or when operating instructions are not adhered to. The Company shall have the option to require the return of any alleged defective part, transportation prepaid, to establish the claim. If the Company's examination shall disclose such parts to have been so defective, the Company will repair or replace said part for the purchaser, f.o.b. Company's plant. The Company's liability in this warranty is limited to the above and in no case can exceed the purchase price of the equipment involved. In no event shall the Company be liable for any consequential damages, secondary charges, expenses or such resulting from any alleged defect.

Any repairs or substitutions made by the purchaser without the written consent of the Company will void all warranties. The Company will not allow charges made by the purchaser for repairs and alterations without written consent or approval from the Company.

IT IS UNDERSTOOD THAT THE COMPANY ASSUMES NO RESPONSIBILITY FOR THE SELECTION OF CONSTRUCTION MATERIALS FOR RESISTANCE TO AND THE EFFECTS OF CORROSION AND/OR EROSION.

B) Performance:

No warranty, either oral, written or implied as to performance of equipment supplied is extended unless specifically stated on the face of the acknowledgement.

SHIPMENT:

A) Special loading, crating or boxing specified by the purchaser will be charged at an additional cost.

B) The Company assumes no responsibility for loss or damage incurred in transit. Claims for such loss or damage should be filed by the purchaser with the carrier.

C) Shipments are normally made charges collect and routed as per the purchaser's instructions unless approval is obtained from purchaser for rerouting to best suit commodity covered. If not specified shipment will be made via "Best Way" at the Company's convenience. The Company reserves the right to make partial shipments and cannot guarantee the extent of assembly of component parts which will vary depending upon the method of shipment used unless specifically covered on the face of this acknowledgement.

INSTALLATION:

The equipment furnished by the Company will be installed by and at the expense of the purchaser. Competent field supervision can be supplied by the Company on a per diem rate plus living and traveling expenses.

FOUNDATIONS AND AUXILIARIES:

In no case will the Company design and detail foundation or provide foundation bolts. Unless otherwise specified, structural supports, stairways, access ladders, platforms, insulation and attachment, connecting duct work, bolts and gaskets for attaching thereto are not included.

SAFETY DEVICES:

No special safety devices are included unless specified to the contrary.

PATENTS:

The Company agrees to defend any suits brought against purchaser for alleged infringement due to construction or design of Company's machinery provided we are immediately informed in writing on receipt of said charges and provided we are given complete control of the defense and also that we have the right to defend or settle the carge or to make necessary changes in the equipment to avoid infringement. We do not agree to defend infringement suits involving accessories not of Company's manufacture or suits based on use of equipment in combination with other equipment or suits involving process patents.

STANDARD SHOP PRACTICE:

All equipment will be cleaned of dirt, loose scale, and spatter. Carbon steel materials will be given one coat of primer unless additional painting is specified in purchaser's order in which case we will advise you of additional charges if applicable

The Company reserves the right to make minor changes or improvements in design and construction.

The Company welcomes purchaser's inspection of materials and workmanship of our equipment in the shop provided such inspection and acceptance does not result in undue delay. If special tests, inspection procedures or pre-assembly resulting in additional expense or delay are specified by the purchaser, the Company will promptly advise the extra charge involved which will be added to the purchase price.

222-1
(BROCHURES)

FIRING INDUSTRIES LTD. LTEE
equipment for the process industries
équipement pour les industries
de transformation

FIRING

MONTREAL [illegible]

[illegible]

November 16, 1983

integ
NOV 18 1983
GH
FILE

INTEG
INTERCONTINENTAL ENGINEERING LTD.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G. R. Cooper, P. Eng.
Project Manager

Subject: ENERGY MINES & RESOURCES CANADA
Combustion Research Facility
Equipment Cost Estimate
File 0243-E1
Inquiry Nos. 241-2, 161-2, 222-1, 211-1, 221-1

Gentlemen:

Based on the inquiries listed above, and our recent telephone conversation, we are pleased to submit our budget proposal to supply the following equipment subject to the terms and conditions below delivered to Ottawa, Ontario.

This proposal is a budget estimate based on standard equipment and on our standard terms and conditions. These features, terms and conditions are negotiable but any changes may result in price increases.

This proposal is subject to a detailed review of the technical specifications at the time of tendering.

~~ITEM I - INQUIRY 241-2~~

~~ROTARY AIRLOCK VALVE FOR FUEL AND SORBENT FEED SYSTEM~~

~~APPLICATION~~

~~To feed fuel from a pressurized feed screw into the combustor feed chute as generally described in your specification 241-2.~~

~~We have assumed that the flow rate of the material is controlled upstream of the rotary valve and that the valve is used only as an airlock.~~

~~The maximum operating temperature for this airlock would be 450° F.~~

....2

ITEM III - INQUIRY NO. 222-1

PNEUMATIC CONVEYING SYSTEM

APPLICATION

To convey crushed limestone at a rate of 720 Kg./hr. from small drums over 20 meters horizontal and 10 meters vertical distance into a filter receiver mounted on a storage bin.

We have chosen a filter receiver in lieu of the requested cyclone due to the dusty nature of the limestone and to prevent damage to the blower assembly.

EQUIPMENT

The conveying system will consist of the following standard PREMIER PNEUMATICS components as generally described in your specification 0243-222.

- Pick up lance 2" dia.
- Lot of 2" conveying line including 4 90° elbows.
- Filter receiver complete with bilter bags, pulse jet cleaning system and discharge rotary aerolock.
- Vacuum blower assembly complete with inlet and outlet silencers and 5 HP TEFC motor and V-belt drive assembly.
- Manual system controls (motor starters by others).

BUDGET SYSTEM PRICE, ex taxes, delivered......Approx.CAN.$20,000.00

~~ITEM IV - INQUIRIES NO. 211-1 and 221-1~~

~~FUEL STORAGE & METERING SYSTEM and LIMESTONE STORAGE AND METERING SYSTEM~~

~~Both of these specifications call for belt type gravimetric type weigh feeders. This type of weigh feeder is not in our product line and we must decline to bid these two items.~~

~~We can supply you an ACCU-RATE Volumetric Type Feeder which could be coupled to a surge hopper as generally described in your specifications and as shown on the attached drawing.~~

.....5

FIRING INDUSTRIES LTD.

CONDITIONS OF SALE

PRICES AND ACCEPTANCE: This quotation may be voided unless executed by you within thirty days from date of proposal. Prices on this quotation are based on foreign exchange, sales taxes, customs tariff and other direct taxes in effect at date of quotation. Orders based on this quotation are accepted at prices subject to change in foreign exchange, sales tax, customs tariff and other direct taxes beyond our control between time of quotation and shipment.

Prices and terms of payment are firm. Terms are 30 days from date of shipment unless otherwise specified in proposal. Interest will be charged on overdue accounts at 24% per annum calculated on a per diem basis. Unless specifically agreed to by us in writing, hold-backs will not be accepted.

PURCHASE ORDERS: Acceptance of all purchase orders is with the mutual understanding that the terms and conditions of this quotation shall apply and prevail over any inconsistent provisions of any such purchase order. All orders are subject to our approval in respect to credit.

DRAWINGS: Drawings will be submitted for approval N/A weeks after receipt of an order. Drawings must not be reproduced or information contained therein transmitted in any manner, directly or indirectly in any way detrimental to our interest, All rights of design and invention are reserved.

DELIVERY: Delivery of products is f.o.b. Ottawa, Ont.
Claims for shortage or damage on shipments must be made immediately against the carrier by the purchaser. The time of delivery is approximate only and is the date of shipment from the factory or warehouse and is based upon date of receipt of approved drawings. In the event of any delay in delivery caused by strikes, accidents, government regulations, delays in transportation, or other causes beyond our control, the delivery shall be extended for a period equal to the time lost by reason of the delay. We accept no responsibility for costs or consequential damages due to failure to deliver as scheduled. If shipments are delayed by the purchaser, payments shall become due as if shipment had been made on dates specified by the purchaser.

TITLE: The title to and right of possession of the equipment remains with us until the contract price has been paid in full by the purchaser.

CANCELLATION CHARGES: Orders may be cancelled only with our approval. A minimum cancellation charge of 15% of the total selling price will be made for any cancellation. This charge will increase accordingly if expenses have been accrued beyond the 15% minimum stated above.

.....2

WARRANTY: Parts proven to be defective within twelve months after shipment will be repaired or, at our option, replaced free of charge f.o.b. factory or origin upon receipt of defective parts at the factory, transportation charges prepaid. It is expressly understood that our liability under this warranty is limited to the furnishing of such replacement parts. We will make no allowance for repair, alterations or other work done, unless specifically agreed to in writing. Goods returned for credit will not be accepted unless the return is authorized by us in writing, and approved returns will be subject to a 15% re-stocking charge. We shall not be liable for consequential damages such as loss of profit, delays, expense or damage, nor for any implied warranties, or warranties other than those set forth herein. Our responsibility for machinery and/or equipment manufactured by others and supplied by us, under this proposal is limited to the guarantee furnished to us by such manufacturers. This warranty does not apply to damages or deterioration of equipment through abrasion or corrosion.

PERFORMANCE: While the equipment quoted is to the best of our knowledge adequate for the intended service as we understand it, no guarantee is undertaken by us unless specifically stated in the proposal.

PERMITS, LICENSES: Purchaser is responsible for the costs and the obtaining of any permits and licenses required for the installation and operation of the offered equipment, including CSA and local hydroelectric approvals.

INSTALLATION COSTS: Prices quoted include only the supply of the specified equipment. No installation or erection costs are included.

TECHNICAL SERVICE: Service and start-up assistance is available at $375.00 per 8-hour day plus reasonable travel and living expenses at cost.

****

March 1983

231-1

PORTABLE HOPPERS

231-1

BIDDER'S LIST

PORTABLE HOPPERS (231-1)

Alpine Steel Ltd.
2525 Skeena St.
Vancouver, B.C.

Burrard Yarrows Corp.
109 E. Esplanade
North Vancouver, B.C.

Alpine

Alpine Steel Ltd.,
2525 Skeena St.,
Vancouver, B.C. V5M 3Y6
(604) 430-1391
Telex 04-508607

Quotation

231-1

Quotation No. 83-575

Date November 3rd, 1983

Integ - Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER. B.C.

V6E 2P4

Gentlemen:

We take pleasure in quoting you as follows:

Re: Energy mines and resources Canada
Atmospheric Recirculation Fluidized
Bed combustion Research Facility
Equipment Cost Estimate

Please see Schedule 1 for prices. These prices are for cost estimate purposes only

NOTE :-

A. Estimate is based on SK 231-1 and 231-2 only (i.e. size of bin) not determined by Alpine Steel Ltd.

B. This is not a tender. For cost estimate purposes only

C. All material prime paint only

D. Federal & Provincial Taxes extra

E. Transportation to Ottawa

Yours very truly,

Alpine Steel Ltd.

H. CHANG.

For all your fabricated steel requirements.

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR LOADING HOPPER

1.	One (1) bucket elevator loading hopper as described in the specification, FOB point of sale	$ 8,223.00
2.	Transportation to site	$ 288.00
	TOTAL	$ 8,511.00

FUEL BIN LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ 6,495.00
2.	Transportation to site	$ 225.00
	TOTAL	$ 6,720.00

SAND LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ 2,661.00
2.	Transportation to site	$ 90.00
	TOTAL	$ 2,751.00

SCHEDULE II - TECHNICAL DATA

PORTABLE HOPPERS

1.0 SPECIFICATIONS

Bucket Elevator Loading Hopper

Manufacturer's name	Alpine Steel Ltd.,	
Vendors name	Alpine Steel Ltd.,	
Hopper outside dimensions	1000W x 1000L x 1500 HT	mm
Total weight	721	kg
Maximum capacity	0.73	m^3
Wall material	A36 Plate	
Wall thickness	6	mm

Fuel Bin Loading Hopper

Manufacturer's name	Alpine Steel Ltd.,	
Vendors name	Alpine Steel Ltd.,	
Hopper outside dimensions	100W x 1000L x 1125 HT	mm
Total weight	558	kg
Maximum capacity	0.46	m^3
Wall material	A36 Plate	
Wall thickness	6	mm

Sand Loading Hopper

Manufacturer's name	Alpine Steel Ltd.,	
Vendors name	Alpine Steel Ltd.,	
Hopper outside dimensions	500 DIA x 1300 HT	mm
Total weight	224	kg
Maximum capacity	0.16	m^3

Wall material	A36 Plate	
Wall thickness	6	mm

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order	3	months

231-1

Burrard Yarrows Corporation

SHIPBUILDERS • SHIP REPAIRERS • GENERAL ENGINEERS
SHIPYARDS: VANCOUVER AND VICTORIA, B.C.

VICTORIA DIVISION

P.O. Box 1030, Victoria, B.C., Canada V8W 2S9
Phone (604) 385-4421/Telex 049-7165

November 22, 1983

integ
NOV 2 5
GRC

Intercontinental Engineering Ltd.,
1155 West Pender Street,
Vancouver, B.C.
V6E 2P4

Attention: Mr. G.R. Cooper, P.Eng.,
Project Manager

Dear Sir:

Re: Portable Hoppers

We submit our quotation as follows, subject to the conditions on the reverse hereof:

To make up and supply three (3) in number portable hoppers in accordance with your enquiry specification $6,067.00
(Six Thousand, Sixty Seven Dollars),
f.o.b. Ottawa, Ontario, exclusive of any applicable taxes.

Our price is based on fabricating and shipping all three hoppers at one time.

Bucket Elevator Loading Hopper	$2,506.
Fuel Bin Loading Hopper	2,271.
Sand Loading Hopper	1,290.
	$6,067.

Our price includes the supply of detailed shop drawings.

All steel would be shotblasted and exterior surfaces only given 1 - 2.5 mil coat of red oxide primer followed by 1 - 2.5 mil coat of machinery enamel.

We are enclosing your completed forms Schedule I and Schedule II.

We thank you for the opportunity of quoting and trust you will find our proposal favourable.

Yours very truly,

BURRARD YARROWS CORPORATION

A. Gillies

A.Gillies,
General Manager,
Victoria Division

MP/jh
Encls.

C/83/169

A Member of the Versatile Group of Companies

GENERAL ENGINEERING - TERMS AND CONDITIONS

1. ACCEPTANCE:

In these conditions the Burrard Yarrows Corporation is referred to as "BYC". Acceptance of this quotation shall constitute acceptance of these conditions which shall apply to and govern all work done or services rendered by BYC, including extras and additional work subsequently ordered. This quotation is subject to acceptance within 30 days from the date hereof and, until accepted, is subject to change upon notice.

2. ADJUSTMENT IN PRICE:

This quotation is based on present costs of labour, materials, services, duties, freight, taxes and exchange. If by reason of any increase or decrease therein before completion of the work, the actual cost to BYC is increased or decreased, the contract price shall be adjusted accordingly.

3. PRICE:

Unless otherwise specified herein:

(a) Prices quoted are f.o.b. BYC's works at Esquimalt, B.C.
(b) All prices quoted are exclusive of Federal and Provincial sales taxes and any other taxes which might be applicable.
(c) Crating, packing, loading and expenses of securing to conveyor are not included in prices quoted.

4. TERMS:

Unless otherwise specified herein, invoices are due and payable 30 days following date of issue.

5. LOSS OR DAMAGE IN TRANSIT:

Unless otherwise specified herein, risk of loss or damage to the items quoted shall pass to customer upon delivery by BYC to carrier.

6. WARRANTY:

Within the limits of this clause, the items quoted herein are warranted to be free of defects in materials and workmanship and if any item or part thereof should show defective materials or workmanship within 60 days from the date of shipment BYC agrees to repair or replace such item or part thereof at its cost at Esquimalt, B.C. upon receipt of sufficient evidence of the defect claimed. Items not manufactured and work not performed by BYC are not warranted except to the extent that the same are warranted to BYC by its suppliers.

7. EXCUSES FOR NON-PERFORMANCE:

BYC shall not be liable for delay or cancellation due to causes beyond its control, including but not limited to strikes, lock-outs, labour disputes, fires, acts of God and inability to obtain necessary labour, material or manufacturing facilities.

8. LIABILITY:

BYC shall in no circumstances whatsoever be liable, nor shall any claim be made against it for indirect or consequential damage arising from delay, breach of warranty or any other cause whatsoever.

9. ASSIGNABILITY:

Neither the contract constituted hereunder nor any claim against BYC arising thereunder shall be assignable by customer without the prior written consent of BYC.

10. CONTRACT SUPERSEDES:

The contract constituted hereunder shall supersede all prior agreements, correspondence and undertakings or commitments, whether oral or written, made between customer and BYC.

11. PATENTS:

Customer shall indemnify and save BYC harmless from and against any liability, royalties, costs or expenses of any kind or nature whatsoever arising out of or by reason of the infringement or claimed infringement of any right of invention, patent, trade mark or process of manufacture involved in the manufacture or use of any design or product not designed by BYC and described in customer's specifications or enquiry.

SCHEDULE I - SCHEDULE OF PRICES

BUCKET ELEVATOR LOADING HOPPER

1.	One (1) bucket elevator loading hopper as described in the specification, FOB point of sale	$ 2,396.00
2.	Transportation to site	$ 110.00
	TOTAL	$ 2,506.00

FUEL BIN LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ 2,191.00
2.	Transportation to site	$ 80.00
	TOTAL	$ 2,271.00

SAND LOADING HOPPER

1.	One (1) fuel bin loading hopper as described in the specification, FOB point of sale	$ 1,230.00
2.	Transportation to site	$ 60.00
	TOTAL	$ 1,290.00

Total - 3 in number Portable Hoppers f.o.b. Ottawa, Ontario exclusive of any applicable taxes.	$ 6,067.00

Our price is based on fabricating and shipping all 3 hoppers at one time.

Our price includes the supply of detailed shop drawings.

All steel would be shotblasted and exterior surfaces only given 1 - 2.5 mil coat of red oxide primer followed by 1 - 2.5 mil coat of machinery enamel.

SCHEDULE II - TECHNICAL DATA

PORTABLE HOPPERS

1.0 SPECIFICATIONS

Bucket Elevator Loading Hopper

Manufacturer's name	Burrard Yarrows Corporation	
Vendors name		
Hopper outside dimensions	1150 x 1000 x 1500	mm
Total weight	205	kg
Maximum capacity	0.67	m^3
Wall material	AISI 1010	
Wall thickness	3	mm

Fuel Bin Loading Hopper

Manufacturer's name	Burrard Yarrows Corporation	
Vendors name		
Hopper outside dimensions	1150 x 1125 x 1000	mm
Total weight	180	kg
Maximum capacity	0.56	m^3
Wall material	AISI 1010	
Wall thickness	3	mm

Sand Loading Hopper

Manufacturer's name	Burrard Yarrows Corporation	
Vendors name		
Hopper outside dimensions	600 dia. x 1300	mm
Total weight	90	kg
Maximum capacity	0.13	m^3

Wall material AISI 1010

Wall thickness 3 mm

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order 3 weeks from order ~~m~~o~~n~~t~~h~~s

241-1

FUEL TRANSFER SCREW NO. 1

241-1

BIDDER'S LIST

FUEL TRANSFER SCREW NO. 1 (241-1)

Christian Engineering
Building 411, Hunters Point
San Francisco, CA
94124

Attn: Mr. Henry Bharwani

FMC of Canada Limited
Material Handling Equipment Division
Suite 1, 636 Clyde Ave.
West Vancouver, B.C.
V7T 1E1

Attn: Mr. Bill Potma

Sullivan Strong Scott Ltd.
3114 Beta Ave.
Burnaby, B.C.
V5G 4K4

Attn: Mr. Jim Graham

Jervis B. Webb Co.
P.O. Box 3428, Stn. "C"
Hamilton, Ont.
L8H 7M5

Attn: Mr. J. Douglas

FMC
FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

QUOTATION

NO. 63EU113V PAGE 1 OF 2

DATE 1983 11 21

☒ YOUR INQUIRY NO 0243-241-1

☐ LETTER OF

☐

☐

☐ PLEASE ADDRESS REPLY TO ABOVE

☒ OR 1-636 Clyde Ave, West Vancouver, BC V7T 1E1

TO INTEG-Intercontinental Engineering Limited
1155 West Pender Street
Vancouver, BC V6E 2P4

ATTENTION Mr. G.R. Cooper, P.Eng.

GENTLEMEN: We thank you for your inquiry and are pleased to submit the following for your consideration.

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
1	1	FMC/LINK-BELT horizontal screw conveyor, 6" dia. x approx. 8'-6" long, heavy service class, carbon steel construction, with 3 flanged inlets and one discharge spout. Unit to operate at 27 rpm maximum for handling 20 cubic feet per hour maximum of 'various' materials weighing 50 to 100 lbs. per cubic foot. Screw: 6" dia. x 6" pitch x 10 guage butt welded sectional flights mounted on 2" dia. schedule 40 pipe collared for 1 1/2" dia. shaft. Trough: 14 guage flanged U-trough approx. 8'-6" long with one special 6" dia. stub discharge spout. Cover: 16 guage flanged and bolted type with felt gasketing for commercially dust tight construction, with 3 inlet spouts, approx. 7"	179 kg		$ 4,408.00	8 weeks	740

Terms apply to this and subsequent pages and are NET 30 DAYS F.O.B. Ottawa, Ontario Freight is extra. Federal and Provincial sales taxes are extra if applicable. Listed estimated shipping times are effective after receipt of an order. Prices are valid for a period of 30 days from date of this quotation and are subject to review if an order is delayed beyond this time. Please refer to general terms and conditions of sale listed on the back of this page.

FMC of Canada Limited
Material Handling Equipment Division

AREA MANAGER J.W. (Bill) Potma

PER Potma

CUSTOMER

FMC
FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

PAGE 2 of 2 OF QUOTATION 63EU113V DATED 83 11 21

TO INTEG

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
		square x 3" high. Terminals: 3/16" thick trough end plates with feet; tail end shaft 1 1/2" dia. with LINK-BELT F200 series ball bearing flange block and waste pack type trough end seal; drive end with 1 1/2" dia. FF200 series ball bearing flange block, waste pack seal, and 1/2 hp shaft mounted speed reducer LINK-BELT model 107D24 class 2 service, special outboard drive arrangement. (variable speed motor and control not included). Assembly: Unit assembled in our shop less drive components, hand turn tested for verification of alignment and shipped as an assembled unit. Finish: Exterior surfaces of steel fabrication will be standard FMC preparation, one coat standard primer and one coat standard finish paint. Note: Reference specification paragraph 6.1, the unit offered is not considered "pressurized airtight" but commercially dust tight only with felt gasketing and continuously welded trough and flanges. Note: Shaft mounted drive seal limited to approx. 200 deg. F (93 deg.C) temperature. Note: FMC general terms and conditions will apply with warranty limited to one against defects in material and workmanship only. Delivery: 8 weeks after approval of drawings. Approval drawings can be submitted in 3 weeks.					

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.1

1.	One (1) screw conveyor system as described in the specification, FOB point of sale *	$ 4,408.00	FOB Ottawa
2.	Canadian Customs Duty (where applicable) 11.4 % of $ 3,208.00	$ 366.00	(included)
3.	Transportation to site	$ 245.00	(included)
	TOTAL	$ 4,408.00	

* Note: As described in our quotation.
Motor and control not included.

FMC of Canada Limited
1983 11 21

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.1

1.0 SPECIFICATIONS

Manufacturer's Name	FMC/LINK-BELT	
Vendor's Name	FMC of Canada Limited	
Model and Type	6" screw conveyor	
Conveyor outside dimensions	178 x 2621	mm
Conveyor weight (c/w drive)	179	kg
Screw diameter	152	mm
Flight material	carbon steel	
Flight thickness	3.6	mm
Shaft diameter	38	mm
Shaft material	cold rolled steel	
Type of bearings	ball bearing flange blocks	
Trough material	carbon steel	
Trough material thickness	1.9 mm	
Variable speed drive - Type	shaft mounted reducer included, but motor and variable speed control not quoted.	
- Manufacturer		
- Model		
- Speed ratio		

Power supply requirements ______ VA _____ V ____ phase

FMC of Canada Limited
1983 11 21

Motor Data motor not quoted

- **Enclosure type** ____________
- **Manufacturer** ____________
- **Output** 0.37 **kW**
- **Speed** 1800 **rpm**
- **Temperature rise** ____________
- **Frame size** ____________

Unit output max. ____________ **kg/s**

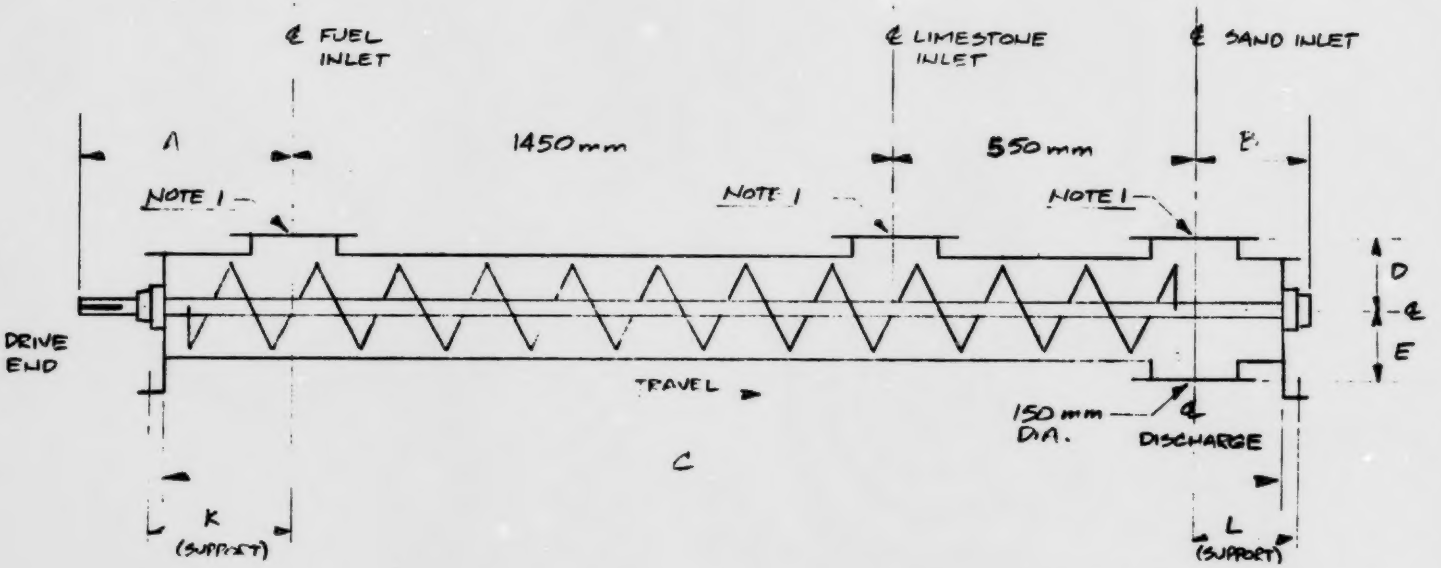
2.0 LIST OF ALTERNATIVES AND EXTRAS

none

3.0 DELIVERY

Time required for manufacture
and shipment from receipt of
order and after receipt of approved drawings 2 **months**
Time required to submit approval drawing 1 month

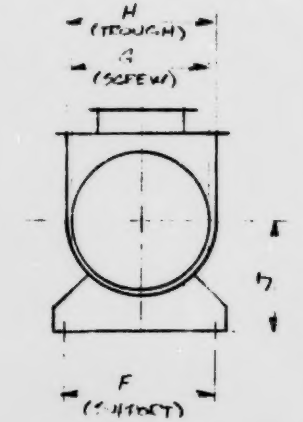
FMC of Canada Limited
1983 11 21



℄ FUEL INLET
℄ LIMESTONE INLET
℄ SAND INLET
A
1450 mm
550 mm
B
NOTE 1
NOTE 1
NOTE 1
D
℄
E
DRIVE END
TRAVEL
150 mm DIA.
℄ DISCHARGE
C
K (SUPPORT)
L (SUPPORT)

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS

A 502 (approx) (mm)
B 457
C 2621
D 191 (approx)
E 127
F 206
G 153 dia. (6" screw)
H 178
J 143
K 305 (approx)
L 305 (approx)



H (TROUGH)
G (SCREW)
J
F (SUPPORT)

FMC of Canada Limited
1983 11 21

NOTES

178 mm sq. x 76 mm high
inlet used for quotation

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.
2. DIMENSIONS D, E & J MUST BE KEPT TO THE MINIMUM POSSIBLE.

ENERGY, MINES AND RESOURCES CANADA

ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE	NTS	DATE	
DRAWN		83-09-14	FUEL TRANSFER SCREW NO. 1 ARRANGEMENT
CHECK			
APP'D.			

A	0243	[illegible]	[illegible]	

241-1

Sullivan Strong Scott

integ
DEC - 8 1983
GW

December 6, 1983

Integ Ltd.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G.R. Cooper, P. Eng.

REF: Inquiry # 241-1 & 242-1

Gentlemen:

Please find enclosed our quotation # 83-3257 covering the supply of two special fuel transfer screw conveyors for the Canmet Energy Research Lab in Ottawa.

Due to the very special nature of the application we cannot quote on the airlocks for this job and the water jacket requirements, including flow rate and temperature would have to be designed by others.

I trust that the enclosed is to your satisfaction for now and hope to hear from you in the future.

Regards,

SULLIVAN STRONG SCOTT LTD.

Jim Graham, Branch Manager

JG/sw

encl.

Bulk materials handling and processing systems. Vancouver Calgary Saskatoon Winnipeg Toronto Montreal Halifax.
Sullivan Strong Scott Ltd., 3114 Beta Avenue, Burnaby, B.C. V5G 4K4
(604) 294-9611 Telex 04-356646

Sullivan Strong Scott
Vancouver Calgary Winnipeg Toronto Montreal Halifax
Bulk Materials Handling and Processing Systems

Date: December 6, 1983

QUOTATION

Reference
83-3257

To: Integ Ltd.
1155 West Pender Street
Vancouver, B.C. V6E 2P4

Attention of:
Mr. G.R. Cooper, P. Eng.

Subject:
REF: Inquiry # 241-1 & 242-1

Gentlemen:

We are pleased to submit herewith our quotation covering our understanding of your requirements.

Sullivan Strong Scott Ltd.
Per:
J. GRAHAM, Branch Manager

Fuel Transfer Screw Conveyor No. 1

ONE - 14" dia. Screw Conveyor Assembly 8'-9" long, horizontal to handle 215 to 1071 CFH of 'fuel' (reject coal, coke, limestone) weighing 100 /cu.ft comprising:-

1 - 8'-6" length 14S616, 14" dia. R.H., Sectional Conveyor Screw, 1/4" thk flights standard intermittently welded to 2 3 1/2" dia. Sch. 80 pipe, flights full pitch with 1 1/2" of bare pipe on discharge end.

1 - 8'-9" length CTF1407, 14" Formed, Flange Trough. Mat'l 3/16" thk mild steel plate with flanges drilled for cover bolting at 6" centers.

1 - 9'-1" length CTC1412F, 14" Flanged Cover. Mat'l 12ga. mild steel punched for bolting.

2 - 14" End Flange Gaskets. standard black neoprene.

1 - Set Cover Gaskets, Fitted.standard black neoprene.

1 - Lot of mild steel assembly nuts and bolts.

3 - 10" dia. Inlet Spouts, approximately 6" high, flanged, drilled, and fitted to trough.

Continued 2/

Fuel Transfer Screw Conveyor # 1 (Continued)

1 - CSD1407, 14" Stub Discharge Spout less Slide, Flanged and drilled, welded to trough 11 1/2" C.L. to End.

2 - CEF142716, 14" Trough End Plates for 2 7/16" dia. Shaft.

1 - CEB2716RB, 2 7/16" dia. flange block, roller bearing (drive end).

2 - CSW2716, 2 7/16" Waste pack seals, fitted.

1 - CEB2716BB, 2 7/16" dia. flange block, ball bearing.

1 - CES2-2716, 2 7/16" Tail Shaft.

1 - CDS3-2716, 2 7/16" Drive Shaft.

4 - 5/8" dia. X 4 3/8" long Bolts with nuts.

Special shop coat (spray applied) high temp. (200°F) primer paint, exterior surfaces only.

1 - Shop fabricated mild steel drive support base.

ONE - 5 H.P. Reliance D.C. Variable Speed Drive, consisting of:

1 - 14C310 minpak plus controller 230 volt, 3 phase, NEMA 12 enclosure.

1 - 5 H.P. Reliance D.C. motor, explosion proof, 1750 RPM, TEFC-XP, 240 volt, DC armature, X254 AC-Frame.

1 - Auxiliary M contact kit containing one normally open and one normally closed contact #14C219.

1 - 9C45 operator station complete with start/stop, run/jog, speed potentiometer.

1 - Red Lion digital speed indicator #DT3-A0-400 complete with explosion proof pickup and gear (LED display on meter).

1 - Eurodrive parallel (Helical) reducer #R80, 25.08:1 ratio, 70 RPM output.

1 - Dodge PX100 Paraflex Coupling 2 1/8" & 2 7/16".

1 - Coupling Guard, M.S. 12ga.

PRICE $ 18,855.00

Continued ...3/

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.1

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ 18,855.00
2.	Canadian Customs Duty (where applicable) _____ % of $ __________	$ __________
3.	Transportation to site	$ 200.00
	TOTAL	$ 19,055.00

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.1

1.0 SPECIFICATIONS

Manufacturer's Name	SULLIVAN STRONG SCOTT LTD.	
Vendor's Name	SULLIVAN STRONG SCOTT LTD.	
Model and Type	SCREW CONVEYOR 14" DIA. U-TYPE	
Conveyor outside dimensions	Approx. (20")508mm X (144") 3658	mm
Conveyor weight (c/w drive)	Approx. (1,165 lbs) 529	kg
Screw diameter	(14") 356	mm
Flight material	MILD STEEL	
Flight thickness	(1/4") 6.35	mm
Shaft diameter	(3") 76.2	mm
Shaft material	C1020 STEEL	
Type of bearings	FLANGE BLOCKS (1-Roller, 1-Ball)	
Trough material	(3/16") 5mm MILD STEEL	
Trough material thickness	(3/16") 5mm	
Variable speed drive		
- **Type**	D.C.	
- **Manufacturer**	RELIANCE	
- **Model**	MINPAK PLUS	
- **Speed ratio**	25.08:1	

Power supply requirements ______ **VA** 230 **V** 3 **phase**

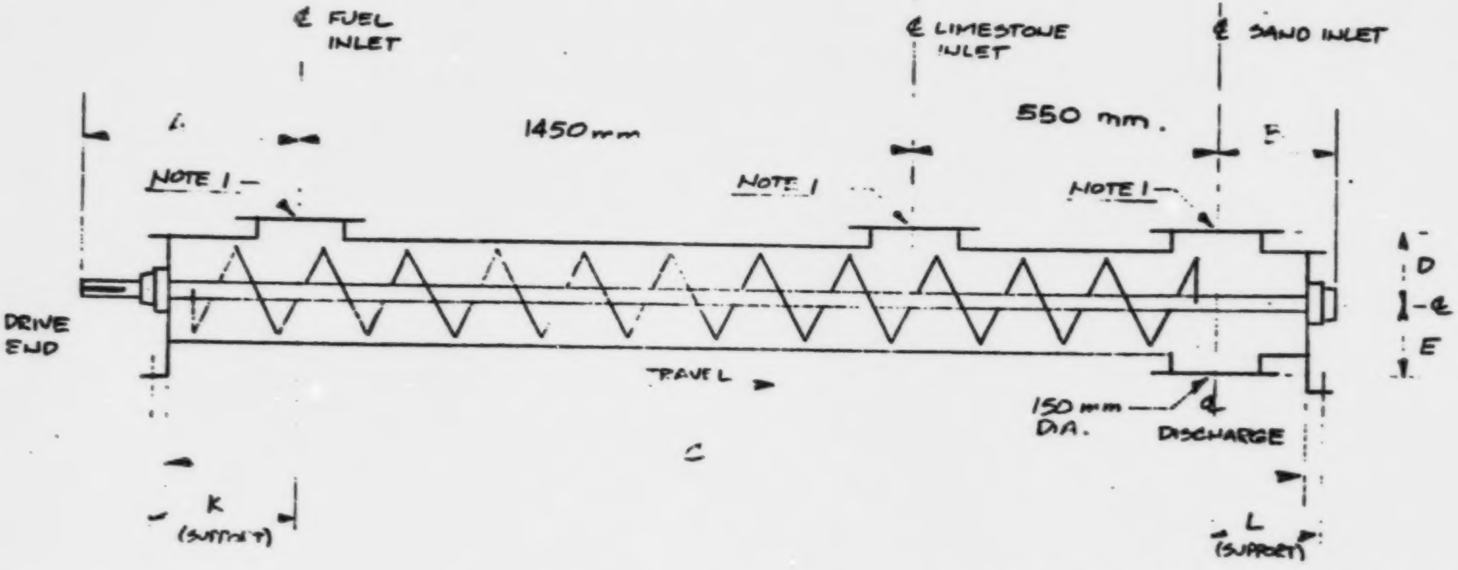
Motor Data

- Enclosure type	TEFC-XP	
- Manufacturer	RELIANCE	
- Output	3.73	kW
- Speed	1750.	rpm
- Temperature rise		
- Frame size	X 254-AC	
Unit output max.	65.6	kg/s

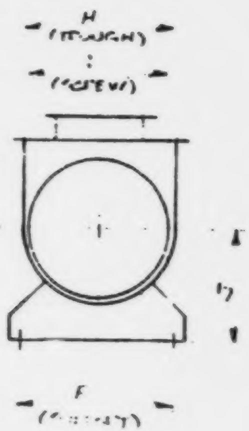
2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order: Approx. 3 months



℄ FUEL INLET
℄ LIMESTONE INLET
℄ SAND INLET
A
1450 mm
550 mm.
B
NOTE 1
NOTE 1
NOTE 1
D
℄
E
DRIVE END
TRAVEL
C
150 mm DIA.
℄ DISCHARGE
K (SUPPORT)
L (SUPPORT)



H (TROUGH)
J (SCREW)
G
F (SUPPORT)

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS

(mm)

A	530	
B	130	mm
C	2667	mm
D	387	mm
E	257	mm
F	343	mm
G	356	mm
H	381	mm
J	276	mm
K	333	mm
L	333	mm

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.
2. DIMENSIONS [illegible] MUST BE LEFT TO THE [illegible].

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE	1:75	DATE
DRAWN		83-09-14
CHECK		

FUEL TRANSFER SCREW NO. 1
ARRANGEMENT

001

241-1

Proposal Number PB-83-780

Proposal Date December 21, 1983

Jervis B. Webb Company of Canada, Ltd

1647 Burlington Street East, HAMILTON, Ontario L8H 7M5 P.O. Box 3428 Stn. C

TO:

Integ
International Engineering Limited
1155 West Pender Street
Vancouver, British Columbia
V6E 2P4

ATTN:

Mr. G. R. Cooper, P. Eng.,
Project Manager

GENTLEMEN:

1. We, the JERVIS B. WEBB COMPANY OF CANADA, LIMITED, a Canadian Corporation, propose, and will contract to furnish, sell and deliver to you, F.O.B. Hamilton, Ontario, the following equipment in accordance with the specifications, terms and conditions stated herein; the same will substantially conform to: your inquiry no. 241-1

DWG Nos. attached sketches

Dated: 83-09-14

accompanying and made part hereof, to the following:—

Two (2) screw conveyors

2. MATERIAL TO BE HANDLED:
(Size, weight, capacity)

Reject coal and coke (minus 19 mm) wood chips (minus 30 mm), limestone (minus 6 mm)

Item No. Fuel Transfer Screw No. 1

Description:

One 6" dia. x 6" pitch x about 7'-6" long horizontal Screw Conveyor to operate at 0.9 to 9.0 RPM for handling 1.03 to 12.56 CFH of reject coal, coke and limestone all as described in Spec. No. 0243-241, project 0243.

Unit shall be air-tight for operating max. pressure of 34 KPAG and have (3) stub inlet spouts and (1) stub discharge. We include a complete 3/4 * HP explosion proof variable speed motor capable of 1.2 to 12.0 operating RPM with speed indicator for 2% accuracy. Operators control in main price is not explosion proof.

Normal operation is at 30% trough loading for all capacities. The unit must not run at 100% loading due to the lumps in some of the materials which could cause excessive power and jamming.

*We calculate 0.038 HP is required by 3/4 HP is smallest motor available to meet your specifications. Screw and drive are protected from damage by one external shear type coupling bolt.

MADE UP OF:

1 Section of mounted screw using 6" dia. x 6" pitch x 1/4" thick B.M. sectional mild steel flights mounted standard on 2" schedule 40 pipe 7'-10" long with 7" of bare pipe at each end. Both ends bushed 1 1/2" dia. standard length but drilled for only (1) coupling bolt (which serves as shear protection at drive end.) Finish O.D. of pipe at feed end smooth for packing gland seal.

1 1-1/2" dia. x about 12" long 1045 CFS 1-bolt tail shaft.

1 1-1/2" dia. x about 16" long 1045 CFS 1-bolt drive shaft, (1) KS.

2 Grade 2 coupling bolts 1/2 dia. x 3 with lock nuts.

1 Tail end trough end 6 x 1-1/2 x 3/16" steel shelf type fitted with:

(1) 2-ring packing gland shaft seal.
(1) Outboard roller bearing pillow block, Dodge type E or equal.

1 Drive end trough end 6 x 2-3/8 double type with about 6" spacing between the plates. Outboard plate with holes for mounting Winsmith reducer. Inboard plate fitted with:

(1) 2-3/8" dia. 2-ring packing gland shaft seal.

1 7'-6" long piece of air-tight 6" x No. 10 GA. flanged type U-trough.

Item No. Fuel Transfer Screw No. 1
Continued

1	150 mm dia. x No. 10 GA. stub discharge with 1/4" bolt flange and spout welded to trough.
1	Air purge connection, 3/4" half pipe coupling.
1	Line of 6" x No. 12 GA. semi-flanged cover bolted air-tight at 6" centers.
3	Stub inlet spouts, No. 12 GA. with 1/4" bolt flanges, approx. 150 mm dia.
1	Lot 1/8" closed cell sponge Neoprene gaskets.
1	Item (1) coat shop standard primer and (1) coat gray finish paint for outside surfaces of fabricated steel.
1	Double worm gear reducer, Winsmith No. MDSFD size 24, ratio 150 to 1 for flange faced motor and flange mounted. Unit is rated 1510" no. torque, .49 HP input.
1	Item shop assembly and bolts.
1	Reliance 3/4 HP MinPak plus DC motor variable speed drive, 175 to 1750 RPM. Motor No. T56H3209 to be explosion proof Class II, Div. 1, group G. To include chassis mounted controller No. T4CZO for 230V-60HZ-1PH. System includes motor mounted tack. generator 2% accuracy, auxiallary contact no. 14C219 with mounting bracket no 14C209 both factory assembled, and factory mounted thermal overload for motor protection with contacts for remote alarm. Main price includes standard encl. operators station with speed indicator, 2% accuracy, speed adjusting Potentiometer start-stop switch, and run-jog selector switch.

NOTE:

Due to the nature of their special application, these two (2) screw conveyors are considered to be experimental units, and therefore do not carry our standard warranty.

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.1

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ 9,986.00
2.	Canadian Customs Duty (where applicable) 12 % of $ 7,542.00	$ 905.00
3.	Transportation to site	$ 142.00
	TOTAL	$ 11,033.00

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.1

1.0 SPECIFICATIONS

Manufacturer's Name	Jervis B. Webb Company Canada, Limited	
Vendor's Name	Jervis B. Webb Company Canada, Limited	
Model and Type		
Conveyor outside dimensions	260 x 270 x 3200	mm
Conveyor weight (c/w drive)	230	kg
Screw diameter	152	mm
Flight material	Mild Steel	
Flight thickness	6	mm
Shaft diameter	38	mm
Shaft material	1045 CFS	
Type of bearings	Outboard RBPB	
Trough material	Mild Steel	
Trough material thickness	3.42 mm (10 GA.)	
Variable speed drive		
- Type	Minpac Plus	
- Manufacturer	Reliance	
- Model	T56H3209	
- Speed ratio	194:1	

Power supply requirements ______ VA 115 V 1 phase

Motor Data

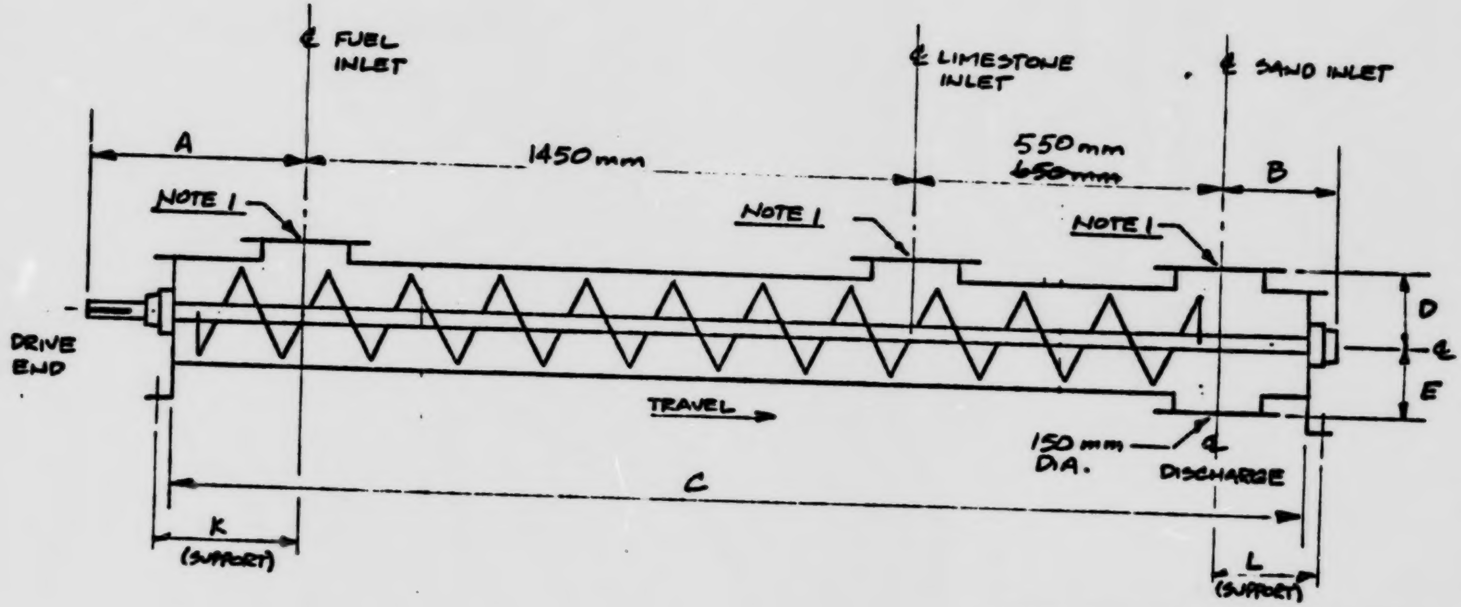
-	Enclosure type	Exp. Pf.	
-	Manufacturer	Reliance	
-	Output	0.56	kW
-	Speed	1750	rpm
-	Temperature rise	80°	C
-	Frame size	WT 56 HC	
	Unit output max.	.019 (min.)	kg/s

2.0 LIST OF ALTERNATIVES AND EXTRAS

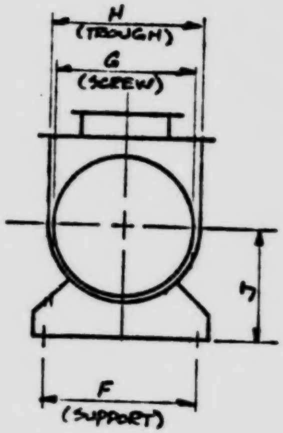
The conveyor drive end is provided with 6" x 2-3/8" double type trough end with about 6" spacing between the plates. About 7" length of screw pipe is flightless protruding through inner end plate, finished to 2-3/8" O.D. for packing gland seal, and drilled for one coupling bolt to serve as shear protection at drive end.

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order	2	months



℄ FUEL INLET
℄ LIMESTONE INLET
℄ SAND INLET
A
1450 mm
550 mm
~~650 mm~~
B
NOTE 1
NOTE 1
NOTE 1
DRIVE END
D
℄
E
TRAVEL
150 mm DIA.
℄ DISCHARGE
C
K (SUPPORT)
L (SUPPORT)



H (TROUGH)
G (SCREW)
J
F (SUPPORT)

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS:

(mm)

A	590
B	370
C	2286
D	200
E	200
F	206
G	152
H	190
J	209
K	170
L	200

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.
2. DIMENSIONS D, E & J MUST BE KEPT TO THE MINIMUM POSSIBLE.

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd.

SCALE	NTS	DATE
DRAWN		83-09-14
CHECK		
APP'D.		

FUEL TRANSFER SCREW NO. 1
ARRANGEMENT

812

A 0242 SK 241-1

241-2
ROTARY AIRLOCK VALVE

241-2

BIDDER'S LIST

FEED SYSTEM ROTARY VALVE (241-2)

Ducon-Mikropul Ltd.
1940 Steeles Ave., East
Bramalea, Ontario
L6T 1A7

Firing Industries Ltd.
60 Picton St.
P.O. Box 230
Niagara-on-the-Lake, Ontario
L0S 1J0

Attn: Mr. Dan Feasby, P.Eng.

241-2
(BROCHURE)

DUCON-MIKROPUL LIMITED
1940 STEELES AVENUE EAST, BRAMALEA, ONTARIO L6T 1A7 · TEL. (416) 791-3883 TELEX 06-97572

December 6, 1983.

integ
DEC 12 1983
GRC
FILE

Integ Intercontinental Engineering Ltd.,
1155 West Pender Street,
VANCOUVER, B.C.,
V6E 2P4.

Attention: Mr. G.R. Cooper

Gentlemen:

Subject: Your File: 0243-El
Energy Mines & Resources Canada
Atmospheric Recirculating Fluidized Bed
Combustion Research Facility
Rotary Airlock
Ducon-Mikropul Proposal: S-5895

We thank you for the above inquiry and are pleased to enclose our proposal S-5895 for your consideration.

We have quoted you our PERMA/flo long life solid feeder which is designed to handle highly abrasive material. For more details please refer to our enclosed bulletin 4300.

The Rotary Airlock is supplied with a variable speed drive in order to get different feed rate for different material.

We trust you will find our enclosed proposal to your entire satisfaction. Should you have any questions, please do not hesitate to call the under-signed.

Yours very truly,
DUCON-MIKROPUL LIMITED.

Swapan Mitra
Engineering Sales.

Encl.

/jv

Integ Intercontinental
Engineering Limited
December 6, 1983

Ducon-Mikropul Proposal: S-5895

EQUIPMENT SPECIFICATION

One (1) only Ducon-Mikropul 4" PERMA/flo Type: B Rotary Airlock of cast iron construction, with adjustable Permalloy (550 Brinell) rotor and shoe. Unit features outboard bearings, air purge hubs, packing gland seals, over size rotor and rotor shaft.
The rotary airlock is also complete with an S.C.R. variable speed drive complete with the following features:-

- Mini Pak plus controller.
- Remote operator station to include speed potentiometer and start/stop switches.
- Blank panel.
- Remote operator kit.
- 3/4 H.P., D.C. motor, 1750 rpm with 90V armature, 50/100 volt field, explosion proof enclosure complete with breather drain.
- Field supply kit.
- Euro drive parallel (helical) gear reducer.
- Speed pick-up unit complete with digital tachometer.

Integ Intercontinental
Engineering Limited
December 6, 1983

Ducon-Mikropul Proposal: S-5895

SCHEDULE 1 - SCHEDULE OF PRICES

FEED SYSTEM
~~FLYASH~~ ROTARY AIRLOCK VALVE:

1.	One (1) rotary airlock valve as described in the specification, F.O.B. point of sale	$ 7,302.00
2.	Canadian Customs Duty (where applicable)	INCLUDED
3.	Transportation to site	$ 200.00 (Estimated
	TOTAL:	$ 7,502.00

Our price is based on:-

F.O.B.:	Point of manufacture.
Delivery:	2 - 2½ months.
All Taxes:	Extra.
Terms:	Net thirty (30) days.
Validity:	Until January 6th, 1983.

817

SCHEDULE II - TECHNICAL DATA

FEED SYSTEM
~~FLYASH RECYCLE~~ ROTARY VALVE

1. SPECIFICATIONS

Manufacturer's name	DUCON-MIKROPUL LIMITED	
Vendor's name	DUCON-MIKROPUL LIMITED	
Airlock model and type	4" PERMA/flo Type: B	
Airlock weight	182 approximately	kg
Airlock outside dimensions	Per Bulletin	mm
Flange size	Per Bulletin	mm
Capacity - minimum	m^3/rev @ rpm	
maximum	.00164 m^3/rev @ rpm	
Airlock motor -		
Manufacturer	RELIANCE	
Enclosure type	EXPLOSION PROOF	
Output	.55	kW
Speed	1750	rpm
Temperature rise	N/A	°C
Frame size	U56HC	
Airlock drive -		
Type	EURODRIVE	
Manufacturer	EURODRIVE	
Speed Ratio	148.85:1	
Power supply voltage	____ VA 115 V 1	phase

2. LIST OF ALTERNATIVES AND EXTRAS

3. DELIVERY

Time required for manufacture and shipment from receipt of order 2 - 2½ months

CONDITIONS OF SALE AND WARRANTY

GENERAL :

A) All purchase orders are subject to acceptance by the home office of Ducon-Mikropul Ltd. as evidenced by a signed acknowledgement which will be forwarded to the purchaser.

B) The contract is entered into at the factory of the seller in Bramalea where the order based hereon is accepted. The entering into, construction, interpretation, performance and discharge of this contract will be governed by the laws of Ontario.

C) In case performance hereunder by the Company shall be delayed or rendered impossible by force majeure, including war, governmental authority, embargoes, prohibition of or restriction on exports or imports, civil commotions, labor difficulties, accidents, loss or damage by act of God or the elements, intereferences with transportation, closing or interruption of customary short routes of transportation or any other contingency beyond the Company's control and whether herein specifically enumerated or not in the connection with the production or transportation of the equipment which is the subject of this order expected arrival shall be extended for a period equal to the duration of the contingency and for a sufficient time thereafter in which to make shipment. The Company shall in no event be held responsible for any contingency beyond its control whether herein specifically provided for or not.

PAYMENT AND SALES TAX:

A) Prices to not include any present or future local, provincial or federal excise, sale privilege or uses taxes. The amount of such taxes will be added to the sales price if the Company is required to pay them.

B) Title to the equipment shall pass to the purchaser upon delivery to the carrier.

C) Prorata payments will become due as shipment is made. If shipments are delayed by the purchaser, payment shall become due on the date the Company is prepared to make shipment. Equipment held for the purchaser shall be at the risk and expense of the purchaser.

D) In the event the purchaser defaults on any payment, or in the event the financial responsibility of the purchaser becomes impaired or unsatisfactory to the Company, the full amount of all payments required hereunder which are unpaid shall, at the election of the Company, become immediately due and payable. Upon default of the purchaser in complying with the terms of the payment hereof, the Company may take immediate possession of any equipment delivered to the purchaser pursuant to the within purchase order without legal process, without demand and for this purpose the Company may enter any premises where said equipment may be found and remove same.

CANCELLATION :

Cancellation of orders accepted by the Company can be made only with the Company's consent. The purchaser shall pay the full purchase price for all items completed. On such items that are not completed, a charge will be made for materials used and labor costs together with sales engineering and administrative overhead plus profit as per the original purchase order. A minimum charge of 10% of purchase price for cancellation will apply.

WARRANTY.

A) Materials:

The Company warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in material and workmanship under normal use and service for twelve (12) months after shipment (except filter tubes - ninety (90) days). This warranty does not cover products, accessories, parts of attachments which are not manufactured by the Company and shall receive only such warranty, if any, as given by the manufacturer thereof. Warranty does not apply where undue wear or breakage is caused by careless or improper handling or where defects are remedied by others or when operating instructions are not adhered to. The Company shall have the option to require the return of any alleged defective part, transportation prepaid, to establish the claim. If the Company's examination shall disclose such parts to have been so defective, the Company will repair or replace said part for the purchaser, f.o.b. Company's plant. The Company's liability in this warranty is limited to the above and in no case can exceed the purchase price of the equipment involved. In no event shall the Company be liable for any consequential damages, secondary charges, expenses or such resulting from any alleged defect.

Any repairs or substitutions made by the purchaser without the written consent of the Company will void all warranties. The Company will not allow charges made by the purchaser for repairs and alterations without written consent or approval from the Company.

IT IS UNDERSTOOD THAT THE COMPANY ASSUMES NO RESPONSIBILITY FOR THE SELECTION OF CONSTRUCTION MATERIALS FOR RESISTANCE TO AND THE EFFECTS OF CORROSION AND/OR EROSION.

B) Performance:

No warranty, either oral, written or implied as to performance of equipment supplied is extended unless specifically stated on the face of the acknowledgement.

SHIPMENT:

A) Special loading, crating or boxing specified by the purchaser will be charged at an additional cost.

B) The Company assumes no responsibility for loss or damage incurred in transit. Claims for such loss or damage should be filed by the purchaser with the carrier.

C) Shipments are normally made charges collect and routed as per the purchaser's instructions unless approval is obtained from purchaser for rerouting to best suit commodity covered. If not specified shipment will be made via "Best Way" at the Company's convenience. The Company reserves the right to make partial shipments and cannot guarantee the extent of assembly of component parts which will vary depending upon the method of shipment used unless specifically covered on the face of this acknowledgement.

INSTALLATION:

The equipment furnished by the Company will be installed by and at the expense of the purchaser. Competent field supervision can be supplied by the Company on a per diem rate plus living and traveling expenses.

FOUNDATIONS AND AUXILIARIES:

In no case will the Company design and detail foundation or provide foundation bolts. Unless otherwise specified, structural supports, stairways, access ladders, platforms, insulation and attachment, connecting duct work, bolts and gaskets for attaching thereto are not included.

SAFETY DEVICES:

No special safety devices are included unless specified to the contrary.

PATENTS:

The Company agrees to defend any suits brought against purchaser for alleged infringement due to construction or design of Company's machinery provided we are immediately informed in writing on receipt of said charges and provided we are given complete control of the defense and also that we have the right to defend or settle the carge or to make necessary changes in the equipment to avoid infringement. We do not agree to defend infringement suits involving accessories not of Company's manufacture or suits based on use of equipment in combination with other equipment or suits involving process patents.

STANDARD SHOP PRACTICE:

All equipment will be cleaned of dirt, loose scale, and spatter. Carbon steel materials will be given one coat of primer unless additional painting is specified in purchaser's order in which case we will advise you of additional charges if applicable

The Company reserves the right to make minor changes or improvements in design and construction.

The Company welcomes purchaser's inspection of materials and workmanship of our equipment in the shop provided such inspection and acceptance does not result in undue delay. If special tests, inspection procedures or pre-assembly resulting in additional expense or delay are specified by the purchaser, the Company will promptly advise the extra charge involved which will be added to the purchase price.

241-2
([illegible])

FIRING INDUSTRIES LTD./LTEE
equipment for the process industries
équipement pour les industries de transformation

FIRING

MONTREAL 6600 TRANS CANADA HWY SUITE 750
POINTE CLAIRE H9R 4S2
TEL (514) 697-8849 TLX 05-821762

HEAD OFFICE 60 PICTON ST P.O. BOX [illegible]
NIAGARA ON THE LAKE ONTARIO [illegible]
TEL (416) 468-3072 TLX [illegible]

November 16, 1983

integ
NOV 18 1983
GRC
FILE

INTEG
INTERCONTINENTAL ENGINEERING LTD.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G. R. Cooper, P. Eng.
Project Manager

Subject: ENERGY MINES & RESOURCES CANADA
Combustion Research Facility
Equipment Cost Estimate
File 0243-E1
Inquiry Nos. 241-2, 161-2, 222-1, 211-1, 221-1

Gentlemen:

Based on the inquiries listed above, and our recent telephone conversation, we are pleased to submit our budget proposal to supply the following equipment subject to the terms and conditions below delivered to Ottawa, Ontario.

This proposal is a budget estimate based on standard equipment and on our standard terms and conditions. These features, terms and conditions are negotiable but any changes may result in price increases.

This proposal is subject to a detailed review of the technical specifications at the time of tendering.

ITEM I - INQUIRY 241-2

ROTARY AIRLOCK VALVE FOR FUEL AND SORBENT FEED SYSTEM

APPLICATION

To feed fuel from a pressurized feed screw into the combustor feed chute as generally described in your specification 241-2.

We have assumed that the flow rate of the material is controlled upstream of the rotary valve and that the valve is used only as an airlock.

The maximum operating temperature for this airlock would be 450° F.

....2

EQUIPMENT

ONE (1) PREMIER PNEUMATICS AEROLOCK Model MDRFS-76-10H-1-P as generally described in the attached brochure and with the following features:

- Drop-thru style housing with a round inlet/outlet.
- Cast iron alloy housing construction.
- 10-blade steel closed hub rotor.
- Standard tipped rotor blades.
- Class 5 rotor clearance for operation at 450°F.
- Lip style shaft seals.
- High temperature packing gland shaft seals.
- Full rotor pocket capacity 0.09 cu.ft./rev.
- Motor drive pre-assembled including:
- 1/2 HP Right SCR Variable Speed motor 115 volt-1-phase-60 cycle with explosion proof enclosure.
- Totally enclosed OSHA drive guard.
- Industrial roller chain reduction drive for final rotor speed of 15 RPM.

BUDGET PRICE, ex taxes, delivered..............Approx.$4,500.00

SHIPMENT: 6-8 weeks

~~ITEM II - INQUIRY 161-2~~

~~ROTARY AIRLOCK FOR FLYASH~~

~~APPLICATION~~

~~To discharge flyash from a baghouse into a pneumatic conveying system.~~

~~We have assumed that the capacity of this airlock is not critical and that a rated capacity of approximately 0.045 cu.ft./rev. and 12 RPM would be acceptable.~~

.....3

FIRING INDUSTRIES LTD.

CONDITIONS OF SALE

PRICES AND ACCEPTANCE: This quotation may be voided unless executed by you within thirty days from date of proposal. Prices on this quotation are based on foreign exchange, sales taxes, customs tariff and other direct taxes in effect at date of quotation. Orders based on this quotation are accepted at prices subject to change in foreign exchange, sales tax, customs tariff and other direct taxes beyond our control between time of quotation and shipment.

Prices and terms of payment are firm. Terms are 30 days from date of shipment unless otherwise specified in proposal. Interest will be charged on overdue accounts at 24% per annum calculated on a per diem basis. Unless specifically agreed to by us in writing, hold-backs will not be accepted.

PURCHASE ORDERS: Acceptance of all purchase orders is with the mutual understanding that the terms and conditions of this quotation shall apply and prevail over any inconsistent provisions of any such purchase order. All orders are subject to our approval in respect to credit.

DRAWINGS: Drawings will be submitted for approval N/A weeks after receipt of an order. Drawings must not be reproduced or information contained therein transmitted in any manner, directly or indirectly in any way detrimental to our interest. All rights of design and invention are reserved.

DELIVERY: Delivery of products is f.o.b. Ottawa, Ont. Claims for shortage or damage on shipments must be made immediately against the carrier by the purchaser. The time of delivery is approximate only and is the date of shipment from the factory or warehouse and is based upon date of receipt of approved drawings. In the event of any delay in delivery caused by strikes, accidents, government regulations, delays in transportation, or other causes beyond our control, the delivery shall be extended for a period equal to the time lost by reason of the delay. We accept no responsibility for costs or consequential damages due to failure to deliver as scheduled. If shipments are delayed by the purchaser, payments shall become due as if shipment had been made on dates specified by the purchaser.

TITLE: The title to and right of possession of the equipment remains with us until the contract price has been paid in full by the purchaser.

CANCELLATION CHARGES: Orders may be cancelled only with our approval. A minimum cancellation charge of 15% of the total selling price will be made for any cancellation. This charge will increase accordingly if expenses have been accrued beyond the 15% minimum stated above.

.....2

WARRANTY: Parts proven to be defective within twelve months after shipment will be repaired or, at our option, replaced free of charge f.o.b. factory or origin upon receipt of defective parts at the factory, transportation charges prepaid. It is expressly understood that our liability under this warranty is limited to the furnishing of such replacement parts. We will make no allowance for repair, alterations or other work done, unless specifically agreed to in writing. Goods returned for credit will not be accepted unless the return is authorized by us in writing, and approved returns will be subject to a 15% re-stocking charge. We shall not be liable for consequential damages such as loss of profit, delays, expense or damage, nor for any implied warranties, or warranties other than those set forth herein. Our responsibility for machinery and/or equipment manufactured by others and supplied by us, under this proposal is limited to the guarantee furnished to us by such manufacturers. This warranty does not apply to damages or deterioration of equipment through abrasion or corrosion.

PERFORMANCE: While the equipment quoted is to the best of our knowledge adequate for the intended service as we understand it, no guarantee is undertaken by us unless specifically stated in the proposal.

PERMITS, LICENSES: Purchaser is responsible for the costs and the obtaining of any permits and licenses required for the installation and operation of the offered equipment, including CSA and local hydroelectric approvals.

INSTALLATION COSTS: Prices quoted include only the supply of the specified equipment. No installation or erection costs are included.

TECHNICAL SERVICE: Service and start-up assistance is available at $375.00 per 8-hour day plus reasonable travel and living expenses at cost.

****

March 1983

242-1

FUEL TRANSFER SCREW NO. 2

242-1

BIDDER'S LIST

FUEL SCREW CONVEYOR NO.2 (242-1)

Christian Engineering
Building 411, Hunters Point
San Francisco, CA
94124

Attn: Mr. Henry Bharwani

FMC of Canada Limited
Material Handling Equipment Division
Suite 1, 636 Clyde Ave.
West Vancouver, B.C.
V7T 1E1

Attn: Mr. Bill Potma

Sullivan Strong Scott Ltd.
3114 Beta Ave.
Burnaby, B.C.
V5G 4K4

Attn: Mr. Jim Graham

Jervis B. Webb Co.
P.O. Box 3428, Stn. "C"
Hamilton, Ont.
L8H 7M5

Attn: Mr. J. Douglas

242-1

CHRISTIAN

integ
NOV 29 1983
DATE

November 22, 1983

INTEG
INTERCONTINENTAL ENGINEERING, LTD.
1155 West Pender Street
Vancouver, B.C.
Canada V6E 2PY

Attention: Mr. G.R. Cooper, Project Manager

Reference: Your Inquiry #0243-1
Our Folio #83785

Dear Mr. Cooper:

We've given you our best price to do the job in accordance with your specifications 0243-0021. However, we must be perfectly honest in pointing out to you that the kind of information that you are asking for here is really proprietary in great measure, and more than that, some of the things that you have requested will not work. We would have to be in the position in telling you that the best price we can give you on the job delivered to Canada, but not including any duty or any freight past the border, would be $14,500.00 net, with the understanding that after you give us the letter of intent, we would, without charge, visit you at your offices and confidentially discuss how the job would properly be built to work. It is only after such frank and open discussion that we could dare to warrant this job. We are hesitant to put everything into our basic proposal.

This sort of frankness may discourage your willingness to place an order with us, and we run that risk. But on the other hand, we have been through this very type of experience before and we know what will make it work. We don't feel, particularly when you are involved in the study, that it is a good time to lay out the kind of data that really should be the subject for a confidentiality agreement. So consider the price firm, consider our interest high and if need be, it might be possible to furnish some of the items/components from Canadian sources.

Thanks so much for coming to us.

Yours very truly,
CHRISTIAN ENGINEERING

E. Wolff

EW:jb

CHRISTIAN ENGINEERING • BUILDING 411 • HUNTERS POINT • SAN FRANCISCO, CA 94124
TELEPHONE: (415) 822-1080 • TELEX NO: 340-236 • CABLE: CHRISENGRS, San Francisco
BULK TRANSFER AND PROCESS EQUIPMENT

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.2

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ 14,500.-
2.	Canadian Customs Duty (where applicable) 13 % of $ 13,500	$ 1,755.-
3.	Transportation to site (Estimate)	$ 250.-
	TOTAL	$ 16,505.-

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.2

1.0 SPECIFICATIONS

Manufacturer's Name	Christian Engineering	
Vendor's Name	–	
Model and Type	XN6 VP FEEDER	
Conveyor outside dimensions	230	**mm**
Conveyor weight (c/w drive)	839	**kg**
Screw diameter	152	**mm**
Screw pitch	75/100/50	**mm**
Flight material	Carbon Steel/T 310 S.S.	
Flight thickness	6	**mm**
Shaft diameter	50	**mm**
Shaft material	C1018	
Type of bearings	PB - Rexnord or Equiv.	
Trough material	Carbon Steel	
Trough material thickness	3.4 mm	
Variable speed drive		
- **Type**	SCR	
- **Manufacturer**	Reliance or Equal.	
- **Model**	W56HC-T56G3202/11C56	
- **Speed ratio**	192:1	
Power supply requirements	230 **VA** 60 **V** 3 **phase**	

Motor Data

- **Enclosure type** TEFC
- **Manufacturer** Reliance
- **Output** .745 **kW**
- **Speed** 1.5 to 4.5 **rpm**
- **Temperature rise** 40 **°C**
- **Frame size** 56

Unit output max. __________ **kg/s**

Water requirements @ design conditions __________ **kg/s**

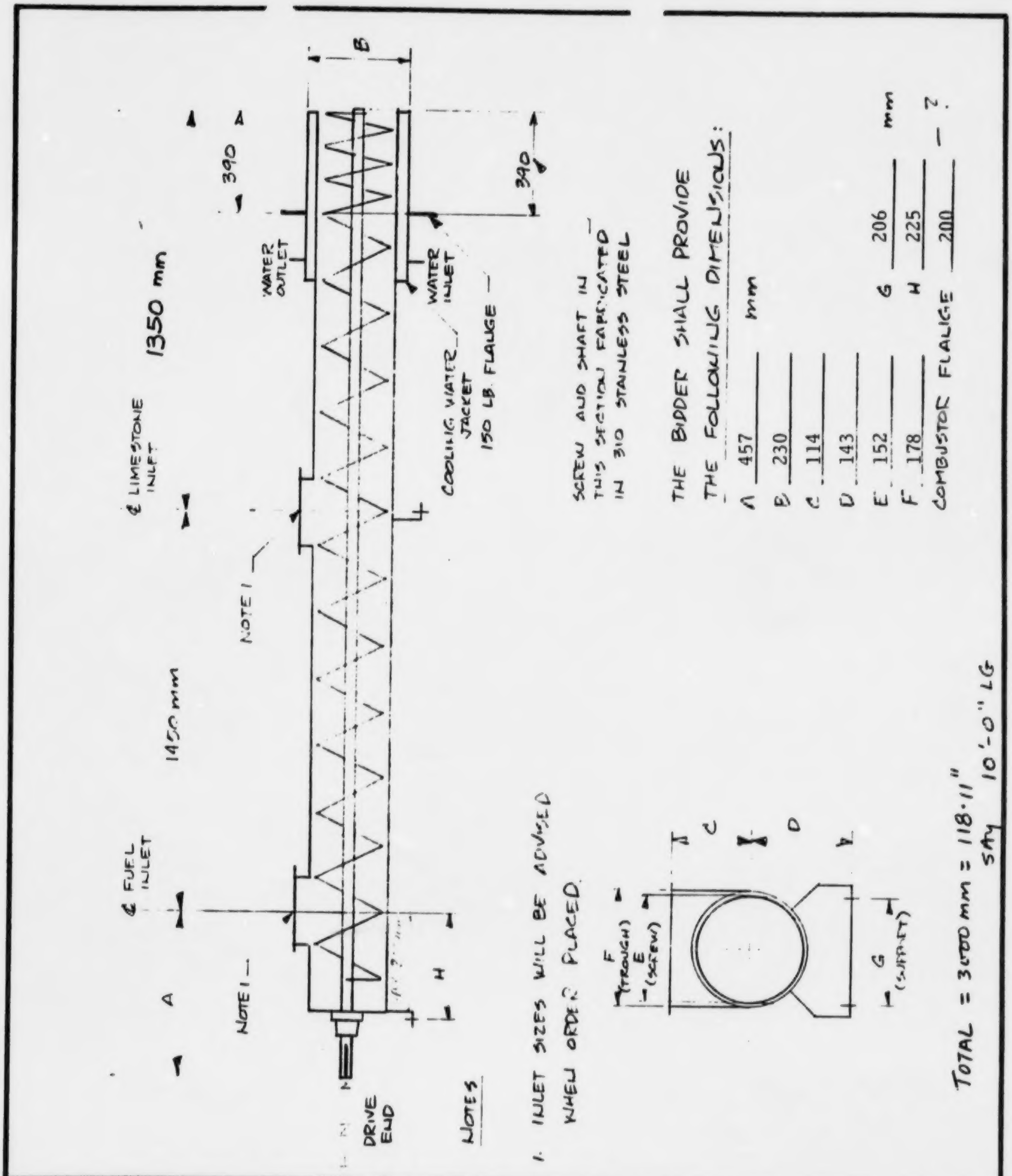
Water jacket dimensions 25 **mm**

Size of combustor mounting flange UKN **mm**

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

Time required for manufacture and shipment from receipt of order __________ **months**


DRIVE END
℄ FUEL INLET
℄ LIMESTONE INLET
NOTE 1
NOTE 1
1450 mm
1350 mm
390
390
A
B
WATER OUTLET
WATER INLET
COOLING WATER JACKET
150 LB. FLANGE
H
F (TROUGH)
E (SCREW)
C
D
G (SUPPORT)

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.

SCREW AND SHAFT IN THIS SECTION FABRICATED IN 310 STAINLESS STEEL

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS:

A 457 mm
B 230
C 114
D 143
E 152
F 178
G 206 mm
H 225
COMBUSTOR FLANGE 200 — Z.

TOTAL = 3000 mm = 118.11" SAY 10'-0" LG

ENERGY, MINES AND RESOURCES CANADA

ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR RESEARCH FACILITY

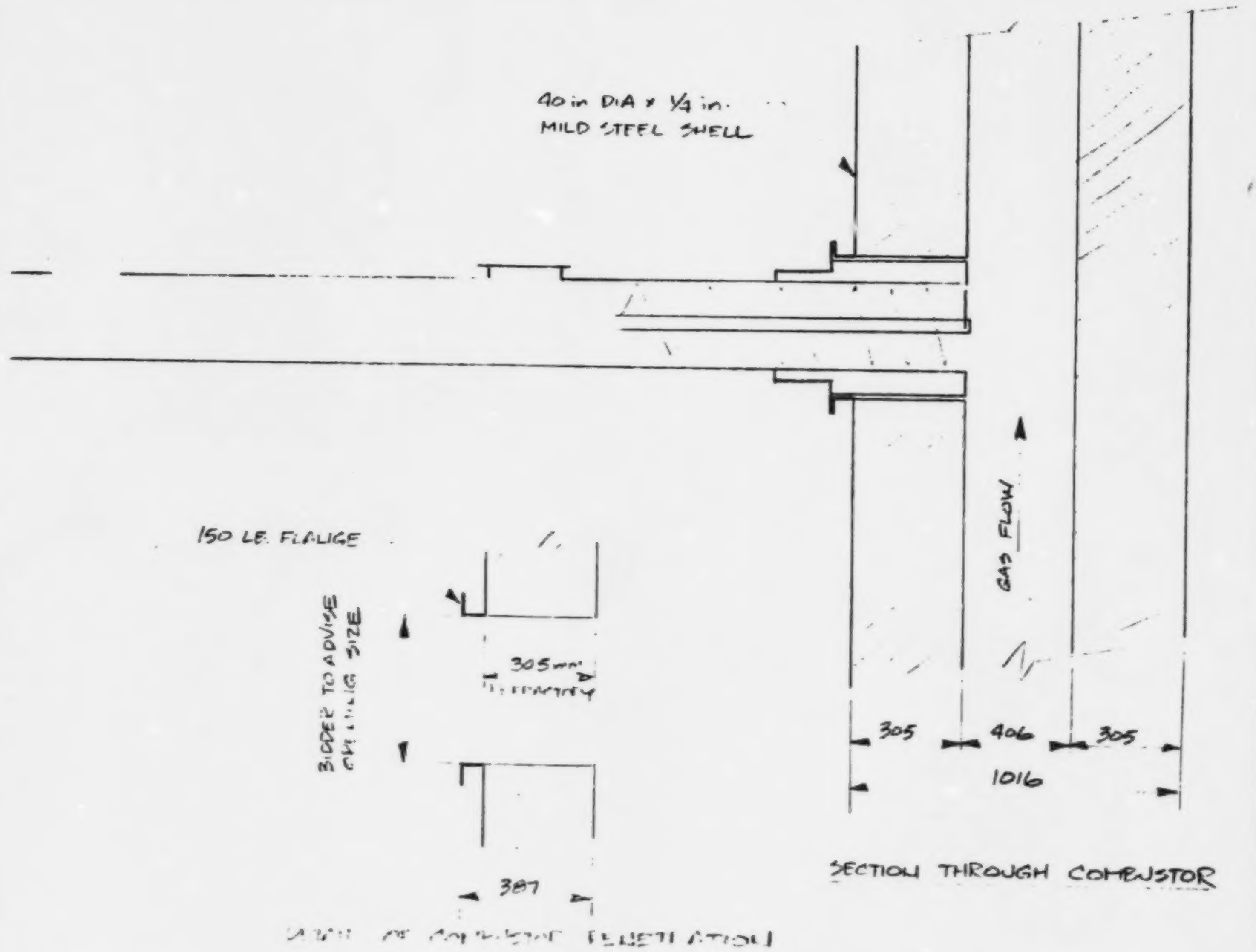
integ
Intercontinental Engineering Ltd

SCALE	NTS	DATE
DRAWN		83-09-14
CHECK		
APP'D.		

FUEL TRANSFER SCREW NO. 2
ARRANGEMENT

SHEET 1

A 0243 242-1


40 in DIA × 1/4 in.
MILD STEEL SHELL
GAS FLOW
305
406
305
1016
SECTION THROUGH COMBUSTOR
150 LB. FLANGE
BIDDER TO ADVISE
OPENING SIZE
305 mm
REFRACTORY
387
VIEW OF COMBUSTOR PENETRATION

ENERGY, MINES AND RESOURCES CANADA			**ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR RESEARCH FACILITY**
integ Intercontinental Engineering Ltd	**SCALE** [illegible]	**DATE**	FUEL TRANSFER SCREW NO. [illegible] INSTALLATION DETAILS SHEET [illegible]
	DRAWN	83-09-14	
	CHECK		
	APP'D.		**A** | 0248 | SK | [illegible]

FMC
FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

QUOTATION

NO. 64EU123V PAGE 1 OF 3

DATE 1983 12 12

YOUR
☒ INQUIRY NO 0243-242-1

☐ LETTER OF

☐

☐

☐ PLEASE ADDRESS REPLY TO ABOVE

☒ OR 1-636 Clyde Ave, West Vancouver, BC V7T 1E1

TO INTEG - Intercontinental Engineering Limited
1155 West Pender Street
Vancouver, BC V6E 2P4

ATTENTION Mr. G.R. Cooper, P.Eng.

GENTLEMEN: We thank you for your inquiry and are pleased to submit the following for your consideration.

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
1	1	FMC/LINK-BELT horizontal screw feeder/conveyor, 6" dia. x approx. 10.1 feet long, heavy service class, carbon steel construction except last 1.3 feet of screw to be 310 stainless steel, with 2 flanged inlets and one " open end" discharge, with water jacket on last 2 ft. approx. Unit to operate at 15 rpm maximum for handling 38 cubic feet per hour maximum of 'various' materials weighing 10 to 100 lbs. per cubic foot. Screw: 6" dia. x 6" pitch x 10 guage butt welded sectional flights mounted on 2" dia. schedule 40 pipe collared for 1-1/2" dia. shaft, last 1.3 ft. approx. changing to 1/2 pitch flights of 310 stainless steel. Trough: 14 guage x approx. 7" dia. tubular trough with 2 special flanged inlets approx. 7" square x 3" high located on 4.75 ft. centres and a special open end discharge.	207 kg		$ 4,785.00	9 weeks	

Terms apply to this and subsequent pages and are NET 30 DAYS F.O.B. Ottawa, Ontario Freight is extra. Federal and Provincial sales taxes are extra if applicable. Listed estimated shipping times are effective after receipt of an order. Prices are valid for a period of 30 days from date of this quotation and are subject to review if an order is delayed beyond this time. Please refer to general terms and conditions of sale listed on the back of this page.

FMC of Canada Limited
Material Handling Equipment Division

AREA MANAGER J.W. (Bill) Potma

PER

FMC
FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

PAGE 2 of 3 OF QUOTATION 64EU123V DATED 8[illegible] 12 12

TO INTEG

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
		Water Jacket: 14 guage x approx. 2.0 ft. long water jacket wrap at dicharge end, approx. 10" dia., for customer application of cooling water. Terminals: 3/16" thick standard steel plate trough end at inlet/drive end, including a 1 1/2" dia. FF200 series double ball bearing flange block and waste pack type trough end seal, and a 1/2 hp shaft mounted reducer LINK-BELT model 107D24 class 2 service, special outboard drive arrangement (variable speed motor and control not included), other end with special open end discharge with stainless steel hanger/stub shaft support. Assembly: Unit assembled in our shop less drive components, hand turn tested for verification of alignment and shipped as an assembled unit. Finish: Exterior surfaces of carbon steel fabrication will be FMC standard shop prime coat painted only. Note: 1. The half pitch screw section at discharge end with the required hanger/stub shaft support creates a "plugging screw". FMC does not accept liability or responsibility for this feed condition. 2. FMC does not accept responsibility for preventing fuel fron burning in the screw conveyor as referred to in specification, paragraph 6.3. The cooling jacket is supplied as requested for customer's application of cooling water. 3. The material handling and feed of material is					

FMC
FMC of Canada Limited
Material Handling Equipment Division
60 Bentley Street, Markham, Ontario L3R 3L2
Telephone: (416) 475-1130 Telex: 06-986290

PAGE 3 of 3 OF QUOTATION 64EU123V DATED 83 12 12

TO INTEG

#	UNIT	DESCRIPTION	EST. WEIGHT	UNIT PRICE	TOTAL	EST. SHIPPING TIME	PR.C.
		Notes continued: not clearly stated in the specification. We have presumed a total of 38 cubic feet per hour. If this is actually less, a proportionally lower rpm may be used. 4. Shaft mounted drive seal limited to approx. 200 deg. F (93 deg. C) temperature. 5. FMC general terms and conditions will apply with warranty limited to one against defects in material and workmanship only. Delivery: 9 weeks after approval of drawings. Approval drawings can be submitted in 3 weeks.					

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.2

1.	One (1) screw conveyor system as described in the specification, FOB point of sale *	$ 4,785.00	FOB Ottawa
2.	Canadian Customs Duty (where applicable) 11.4 % of $ 3,498.00	$ 399.00	(included)
3.	Transportation to site	$ 250.00	(included)
	TOTAL	$ 4,785.00	

* Note: As described in our quotation.
Motor and control not included.

FMC of Canada Limited
1983 11 25

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.2

1.0 SPECIFICATIONS

Manufacturer's Name	FMC/LINK-BELT	
Vendor's Name	FMC of Canada Limited	
Model and Type	6" screw conveyor	
Conveyor outside dimensions	178 x 3079	mm
Conveyor weight (c/w drive)	207	kg
Screw diameter	152	mm
Screw pitch	first section 152 last section 76	mm
Flight material	first section carbon steel last section 310 stainless steel	
Flight thickness	3.6	mm
Shaft diameter	38	mm
Shaft material	first section cold rolled steel last section 310 stainless steel	
Type of bearings	drive end: double ball brg. flange block discharge: stainless steel hanger bearing	
Trough material	first section: carbon steel last section: stainless steel	
Trough material thickness	1.9 mm	
Variable speed drive	shaft mounted reducer included, but motor and variable speed control not quoted.	
- Type		
- Manufacturer		
- Model		
- Speed ratio		
Power supply requirements	______ VA _____ V ____ phase	

FMC of Canada Limited
1983 12 12

Motor Data	motor not quoted		
- Enclosure type			
- Manufacturer			
- Output		0.37	kW
- Speed		1800	rpm
- Temperature rise			°C
- Frame size			
Unit output max.			kg/s
Water requirements @ design conditions	to be specified by others		kg/s
Water jacket dimensions	approx.	254 x 610	mm
Size of combustor mounting flange		432 approx.	mm

2.0 LIST OF ALTERNATIVES AND EXTRAS

none

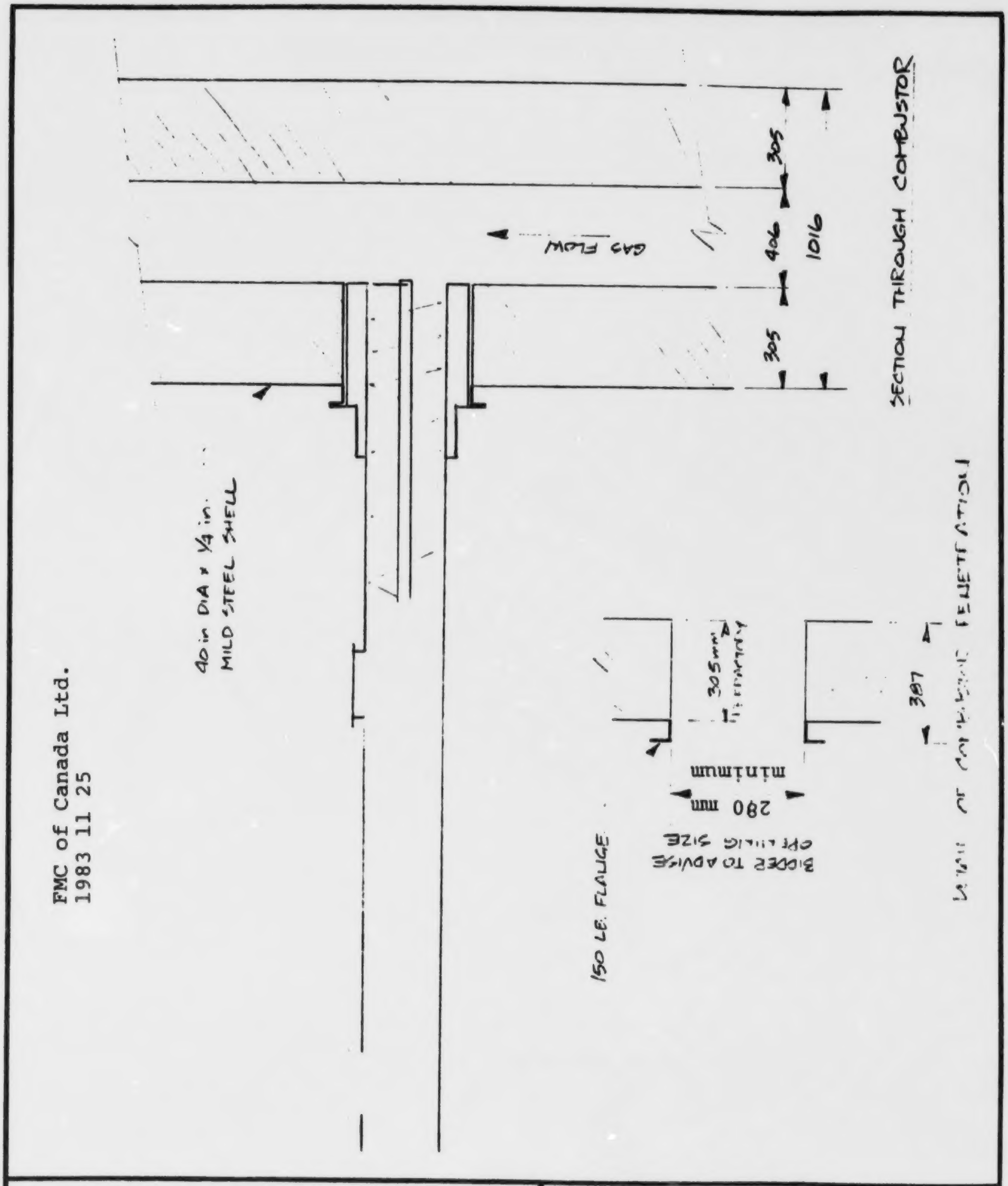
3.0 DELIVERY

Time required for manufacture and shipment from receipt of order and after receipt of approved drawings 2 months

Time required to submit approval drawings 1 month

FMC of Canada Limited
1983 12 12

FMC of Canada Ltd.
1983 11 25


SECTION THROUGH COMBUSTOR
GAS FLOW
305
406
1016
305
40 in DIA x 1/4 in. MILD STEEL SHELL
305 mm minimum
387
280 mm minimum
BIDDER TO ADVISE OPENING SIZE
150 LB. FLANGE
VIEW OF COMBUSTOR FENESTRATION

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

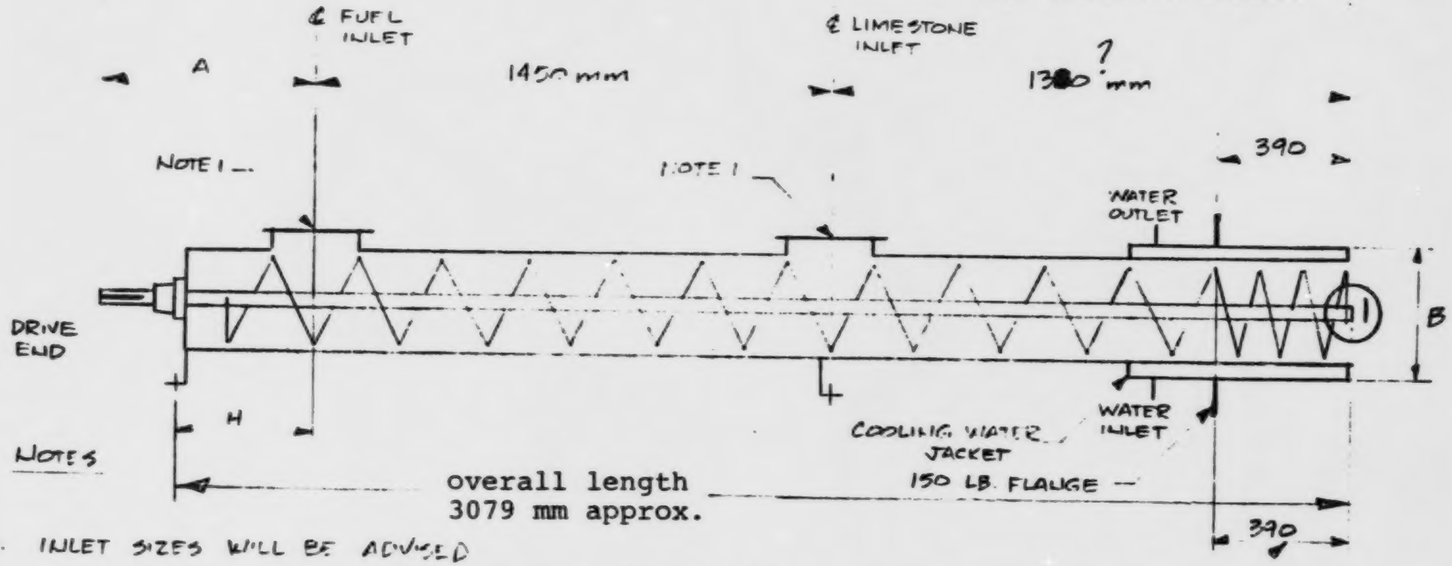
integ
Intercontinental Engineering Ltd

SCALE	NTS	**DATE**	
DRAWN		83-09-14	
CHECK			
APP'D.			

FUEL TRANSFER SCREW NO. 2
INSTALLATION DETAILS
SHEET 2

A	**0243**	SK	243-1

① Note: Open end discharge with hanger - stub shaft support, stainless stl. with H.I. brg. and hardened shaft.

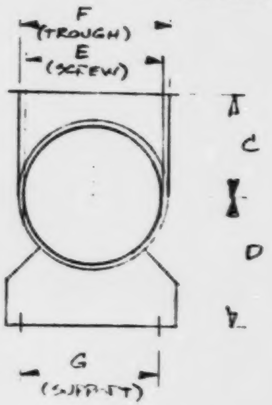

℄ FUEL INLET
℄ LIMESTONE INLET
A
1450 mm
1380 ? mm
390
NOTE 1
NOTE 1
WATER OUTLET
DRIVE END
B
①
H
WATER INLET
COOLING WATER JACKET
150 LB. FLANGE
390

overall length
3079 mm approx.

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED (178 mm sq. x 76 mm high inlet used for quotation)

SCREW AND SHAFT IN THIS SECTION FABRICATED IN 310 STAINLESS STEEL


F (TROUGH)
E (SCREW)
C
D
G (SUPPORT)

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS:

A 502 (approx)mm
B 254 (approx)
C 191
D 143
E 153 dia.
F 178 inside
G 206 (approx)mm
H 305 (approx)
COMBUSTOR FLANGE ________

FMC of Canada Ltd.
1983 11 25

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE	NTS	DATE	
DRAWN		83-09-14	
CHECK			
APP'D.			

FUEL TRANSFER SCREW NO. 2
ARRANGEMENT

SHEET 1

A | 0243 | | 243-1

242-1

Sullivan Strong Scott

Integ
DEC-8 1983

December 6, 1983

Integ Ltd.
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Attention: Mr. G.R. Cooper, P. Eng.   REF: Inquiry # 241-1 & 242-1

Gentlemen:

Please find enclosed our quotation # 83-3257 covering the supply of two special fuel transfer screw conveyors for the Canmet Energy Research Lab in Ottawa.

Due to the very special nature of the application we cannot quote on the airlocks for this job and the water jacket requirements, including flow rate and temperature would have to be designed by others.

I trust that the enclosed is to your satisfaction for now and hope to hear from you in the future.

Regards,

SULLIVAN STRONG SCOTT LTD.

Jim Graham, Branch Manager

JG/sw

encl.

Bulk materials handling and processing systems. Vancouver Calgary Saskatoon Winnipeg Toronto Montreal Halifax.
Sullivan Strong Scott Ltd., 3114 Beta Avenue, Burnaby, B.C. V5G 4K4
(604) 294-9611 Telex 04-356646

(SEE PROPOSAL FOR 241-1)

Integ Ltd. (Continued)

December 6, 1983

Fuel Transfer Screw Conveyor No. 2

ONE - 12" dia. Screw Conveyor Assembly 10'-0" long, horizontal to handle 104 to 1073 CFH of 'fuel' (reject coal, coke/limestone, wood) weighing from 10 to 100/cu.ft. comprising:-

1 - Special 9'-10" long 11" dia. Sectional conveyor screw fabricated of mild steel and of type 310 stainless steel. Unit will have 8'-8" of mild steel flights complete (with rider flights) mounted on 3" dia. Sch. 40 pipe and 1'-3" of stainless steel flight mounted on 2 2 7/16" dia. Shaft.

1 - Special 12" dia. 8'-9" long solid tubular trough fabricated of 12" dia. Sch. 40 (.406" wall) mild steel pipe.

2 - 10" dia. inlet spouts, approximately 6" high, fabricated of 10" dia. Sch. 40 mild steel pipe, complete with standard 150 drilled slip on flange.

1 - 12" end gasket to suit tubular trough. (Asbestos)

1 - Lot of mild steel assembly nuts and bolts.

1 - 2'-0" long water jacket fabricated of type 310 stainless steel complete with 1 1/2" dia. screwed inlet and outlet connections.

1 - Special CEOT123 pedestal type trough end plate for double pillow block bearings and to suit 3" dia. shaft, mat'l mild steel.

1 - 3" dia. packing gland seal fitted complete with asbestos packing.

2 - CPB3RB, 3" dia. roller bearing pillow blocks for inlet end.

1 - Mild steel mounting flange shop fabricated for 1/2" thk mild steel plate.

1 - 3" dia. drive shaft, approximately 2'-6" long, mat'l mild steel . (Note: shaft welded to conveyor screw).

1 - Lot of special painting for mild steel, SS PC6 sand blast and 2 coats of epoxy paint suitable for 200°F.

ONE - 7.5 H.P. Reliance D.C. Variable Speed Drive, consisting of:-

1 - 14C310 minpak plus controller 230 volt, 3 phase, NEMA 12 enclosure.

1 - 7.5 HP. Reliance D.C. Motor, explosion proof, TEFC-XP, 240 volt DC Armature, X256 AC-Frame.

1 - Auxiliary M contact kit # 14C219.

1 - 9C45 operator station complete with start/stop, run/jog, speed potentiometer.

Continued 4/

842

Integ Ltd. (Continued) December 6, 1983

Fuel Transfer Screw Conveyor No. 2 (Continued)

1 - Red Lion digital speed indicator #DT3-A0-400 complete with explosion proof pickup and gear (LED display on meter).

1 - Eurodrive parallel (Helical) reducer #R90, 45.85:1 ratio, 38 RPM output RPM.

1 - Shop fabricated mild steel drive base.

1 - Dodge PX140 Paraflex Coupling 2 3/8" & 3" Bore.

1 - Coupling Guard 12ga.

PRICE $ 26,436.00

Above conveyors assembled, fitted, match-marked and test run.

F.O.B. Toronto
Sales Taxes Extra, if applicable.
Delivery: 8 - 9 weeks after receipt of approved dwgs.
allow 2 weeks for dwgs.

242-1
SULLIVAN STRONG SCOTT
(SEE LETTER WITH 241-1)

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.2

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ 26,436.00
2.	Canadian Customs Duty (where applicable) _____ % of $ _________	$ _________
3.	Transportation to site	$ 400.00
	TOTAL	$ 26,836.00

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.2

1.0 SPECIFICATIONS

Manufacturer's Name	SULLIVAN STRONG SCOTT LTD.	
Vendor's Name	SULLIVAN STRONG SCOTT LTD.	
Model and Type	Screw Conveyor 12" Dia. Tubular	
Conveyor outside dimensions	Approx.(24") 610mm X (156") 3963	mm
Conveyor weight (c/w drive)	Approx. 900	kg
Screw diameter	(11") 280	mm
Screw pitch	VARIABLE	mm
Flight material	MILD STEEL & 310 ST. STEEL	
Flight thickness	(3/16") 5	mm
Shaft diameter	(3") 77	mm
Shaft material	C1020 STEEL & 310 ST. STEEL	
Type of bearings	ROLLER BEARING PILLOW BLOCK	
Trough material	MILD STEEL PIPE	
Trough material thickness	(.406") 11mm	
Variable speed drive		
- Type	D.C.	
- Manufacturer	RELIANCE	
- Model	MINPAK PLUS	
- Speed ratio	45.85:1	

Power supply requirements ______ VA 230 V 3 phase

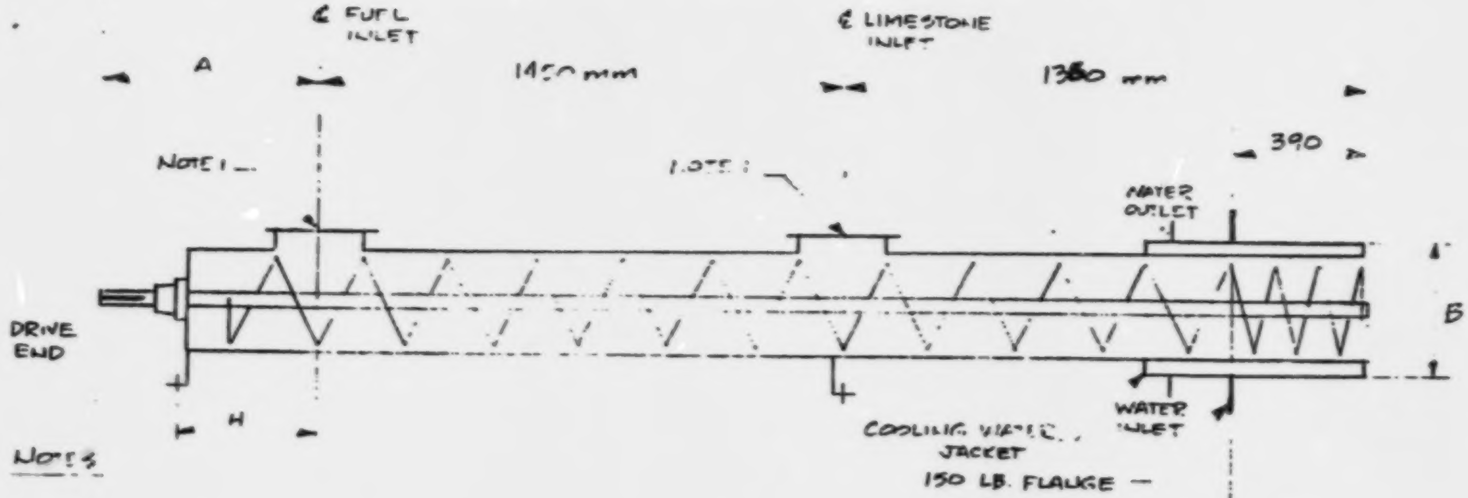
Motor Data

- Enclosure type	TEFC-XP	
- Manufacturer	RELIANCE	
- Output	5.60	kW
- Speed	1750	rpm
- Temperature rise		°C
- Frame size	X256 AC	
Unit output max.	1.35	kg/s
Water requirements @ design conditions	BY CUSTOMER	kg/s
Water jacket dimensions	51mm Deep Baffle X 610	mm long.
Size of combustor mounting flange	610mm O.D. X 445	mm I.D.

2.0 LIST OF ALTERNATIVES AND EXTRAS

3.0 DELIVERY

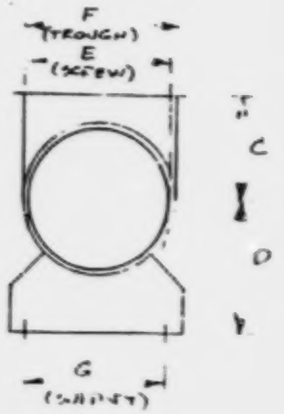
Time required for manufacture and shipment from receipt of order	Approx. 3	months



℄ FUEL INLET
℄ LIMESTONE INLET
A
1450 mm
1380 mm
390
NOTE 1
NOTE 1
WATER OUTLET
WATER INLET
DRIVE END
B
H
COOLING WATER JACKET
150 LB. FLANGE
390

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED



F (TROUGH)
E (SCREW)
C
D
G (SUPPORT)

SCREW AND SHAFT IN THIS SECTION FABRICATED IN 310 STAINLESS STEEL

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS:

A	826	mm
B	445	mm
C	260	mm
D	245	mm
E	279	mm
F	303	
G	312	mm
H	270	

COMBUSTOR FLANGE 610mm O.D. X 445mm ID. X 13mm THICK

ENERGY, MINES AND RESOURCES CANADA

ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTOR RESEARCH FACILITY

Interconnental Engineering Ltd

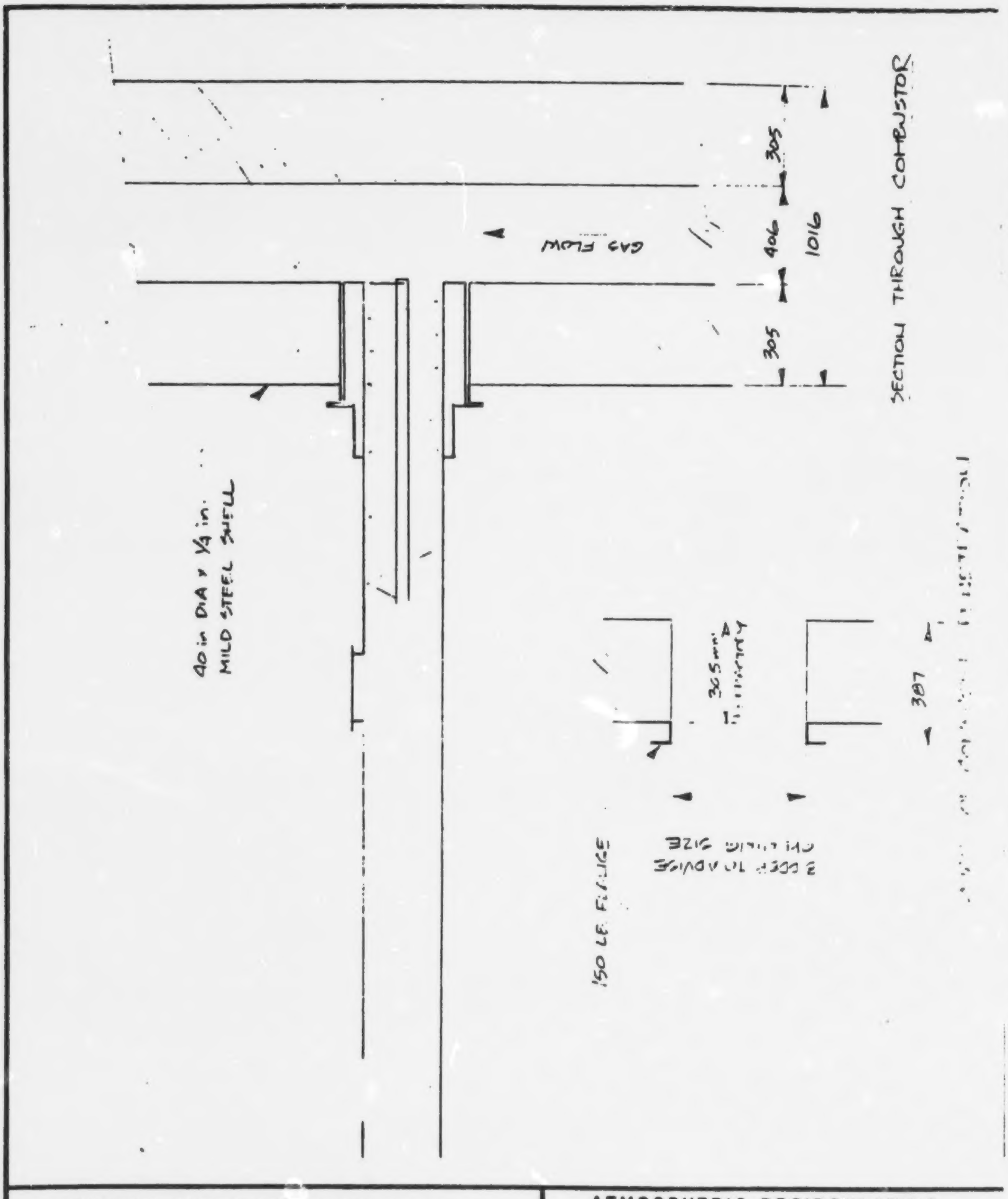
SCALE	[illegible]	DATE	
DRAWN		83-09-14	
CHECK			
APP'D.			

FUEL TRANSFER SCREW NO. 2
ARRANGEMENT

SHEET 1

847

A | 0243 | [illegible] | 243-1


SECTION THROUGH COMBUSTOR
305
406
1016
305
GAS FLOW
40 in DIA x 1/4 in. MILD STEEL SHELL
305 mm
387
150 LB FLANGE

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

SCALE	1:5	**DATE**	
DRAWN		83-09-14	
CHECK			
APP'D.			

FUEL TRANSFER SYSTEM NO. 2
INSTALLATION DETAILS
SHEET 2

A	**0243**	[illegible]	[illegible]	

241-1

Proposal Number PB-83-780

Proposal Date December 21, 1983

Jervis B. Webb Company of Canada, Ltd 1647 Burlington Street East, HAMILTON, Ontario L8H 7M5 P.O. Box 3428 Stn. C

TO:
Integ
International Engineering Limited
1155 West Pender Street
Vancouver, British Columbia
V6E 2P4

ATTN:
Mr. G. R. Cooper, P. Eng.,
Project Manager

GENTLEMEN:

1. We, the JERVIS B. WEBB COMPANY OF CANADA, LIMITED, a Canadian Corporation, propose, and will contract to furnish, sell and deliver to you, F.O.B. Hamilton, Ontario, the following equipment in accordance with the specifications, terms and conditions stated herein; the same will substantially conform to: your inquiry no. 241-1

DWG Nos. attached sketches

Dated: 83-09-14

accompanying and made part hereof, to the following:—

Two (2) screw conveyors

2. MATERIAL TO BE HANDLED:
(Size, weight, capacity)

Reject coal and coke (minus 19 mm) wood chips (minus 30 mm), limestone (minus 6 mm)

Item No. Fuel Transfer Screw No. 2

Description:

Note: Our design of the material plugging seal feature at the discharge end varies from your design. Instead we omit all screw for final 10". The final flight will be double flighted. All flights are full pitch.

One 6" dia. x 6" pitch x about 9'-9" long open end horizontal Screw Conveyor to operate at 0.85 to 4.2 RPM for handling 1 to 20 CFH of reject coal, fluid coke, limestone, and wood, all as described in spec. No. 0243-242, project 0243, normal operation is at 95% * trough loading. Unit shall be air-tight for operation max. pressure of 52KPAG. Final 2'-0" of the 7" O.D. pipe housing shall have a mild steel water jacket. Final pitch of the screw and tube and final 18" of 7" O.D. tubular housing will be made of No. 310 or similar stainless steel. To have (2) stub inlets and a 10" pipe 150 lbs. seal flange on OD, of water jacket. We include a 3/4 HP variable speed D.C. motor and reducer all as previously specified herein for Screw No. 1 except reducer ratio will be 400 to 1.

Screw and drive are protected from damage as noted for Screw No. 1.

* Note: Screw must not be operated at 100% loading when material contains lumps.

1 Section of mounted screw using 6" dia. x 6" pitch x 1/4" thick. B.W. sectional flights mounted on 2" schedule 40 mild steel pipe 9'-2" long with 7" of bare pipe at feed end and OD of the 7" long bare pipe finished for packing gland seal. First 8'-0" of flights to be single flighted and mild steel. Final 7" of flights to be double flighted of No. 310 stainless steel or similar construction including No. 14 GA. wrapper on outside of mild steel pipe end seal plate over pipe end. Feed end of pipe bushed standard for 1-1/2" dia. shaft but drilled for only (1) coupling bolt.

1 1-1/2" dia. x 16" long 1045 CFS 1-bolt drive shaft (1) KS.

1 Grade 2 coupling bolt, 1/2" dia. x 3 with lock nut.

1 Drive end trough end 6 x 2-3/8" double type with about 6" spacing between the plates. Outboard plate with holes for mounting Winsmith reducer. Inboard plate fitted with:

(1) 2-3/8" dia. 2-ring packing gland shaft seal.

Item No. Fuel Transfer Screw No. 2
Continued

1	About 9'-8" long section of 7" O.D. x 1/8" wall tubular casing, first 8'-2" to be mild steel and final 18" of No. 310 or similar stainless steel. Final 2'-0" shall have a 10" standard pipe water cooling jacket all made of mild steel with 3/4" half coupling water inlet and outlet. (See Note below)
1	10" 150 lb. forged steel slip-on flange welded to jacket.
1	3/4" half coupling air purge connection.
2	Stub inlet spouts, No. 12 GA. with 1/4" bolt flanges, approximately 150 mm dia.
1	Lot 1/8" closed cell sponge Neoprene gaskets.
1	Item (1) coat shop standard primer and (1) coat gray finish paint for outside surfaces of fabricated steel.
1	Double worm gear reducer, Winsmith No. MDSFD size 24, ratio 400 to 1 for flange faced motor and flange mounted. Unit is rated 1510" No. torque, .49 HP input.
1	Casing support saddle.
1	Item shop assembly and bolts.
1	Reliance 3/4 HP MinPack plus DC motor variable speed drive, 175 to 1750 RPM, Motor No. T56H3209 to be explosion proof Class II, Div. 1, group G. To include chassis mounted controller No. 14C20 for 230V-60HZ-1PH. System includes motor mounted tach. generator 2% accuracy, auxiallary contact No. 14C219 with mounting bracket No. 14C209 both factory assembled, and factory mounted thermal over load for motor protection with contacts for remote alarm. Main price includes standard encl. operators station with speed indicator, 2% accuracy, speed adjusting Potentiometer, start-stop switch, and run-jog selector switch.

Note: Our shop welders will weld the jacket for a max. operating pressure of 14.9 p.s.i.g.

NOTE:

Due to the nature of their special application, these two (2) screw conveyors are considered to be experimental units, and therefore do not carry our standard warranty.

SCHEDULE I - SCHEDULE OF PRICES

FUEL TRANSFER SCREW NO.2

1.	One (1) screw conveyor system as described in the specification, FOB point of sale	$ 10,389.00
2.	Canadian Customs Duty (where applicable) 12 % of $ 7,791.00	$ 935.00
3.	Transportation to site	$ 193.00
	TOTAL	$ 11,517.00

SCHEDULE II - TECHNICAL DATA

FUEL TRANSFER SCREW NO.2

1.0 SPECIFICATIONS

Manufacturer's Name	Jervis B. Webb Company Canada, Limited	
Vendor's Name	Jervis B. Webb Company Canada, Limited	
Model and Type		
Conveyor outside dimensions	260 x 270 x 3600	mm
Conveyor weight (c/w drive)	300	kg
Screw diameter	152	mm
Screw pitch	152	mm
Flight material	Mild steel and S.S. steel	
Flight thickness	6	mm
Shaft diameter	38	mm
Shaft material	1045 CFS	
Type of bearings	-	
Trough material	Mild steel and S.S. steel	
Trough material thickness	3.2 mm tubular	
Variable speed drive		
- Type	Minpac plus	
- Manufacturer	Reliance	
- Model	T56H3209	
- Speed ratio	407:1	
Power supply requirements	____ VA 115 V 1 phase	

Motor Data

- Enclosure type	Exp. Pf.	
- Manufacturer	Reliance	
- Output	0.56	kW
- Speed	1750	rpm
- Temperature rise	80	°C
- Frame size	WT56HC	
Unit output max.	.019 (Min.)	kg/s
Water requirements @ design conditions		kg/s
Water jacket dimensions	252 Dia. x 610	mm
Size of combustor mounting flange	400 dia.	mm

2.0 LIST OF ALTERNATIVES AND EXTRAS

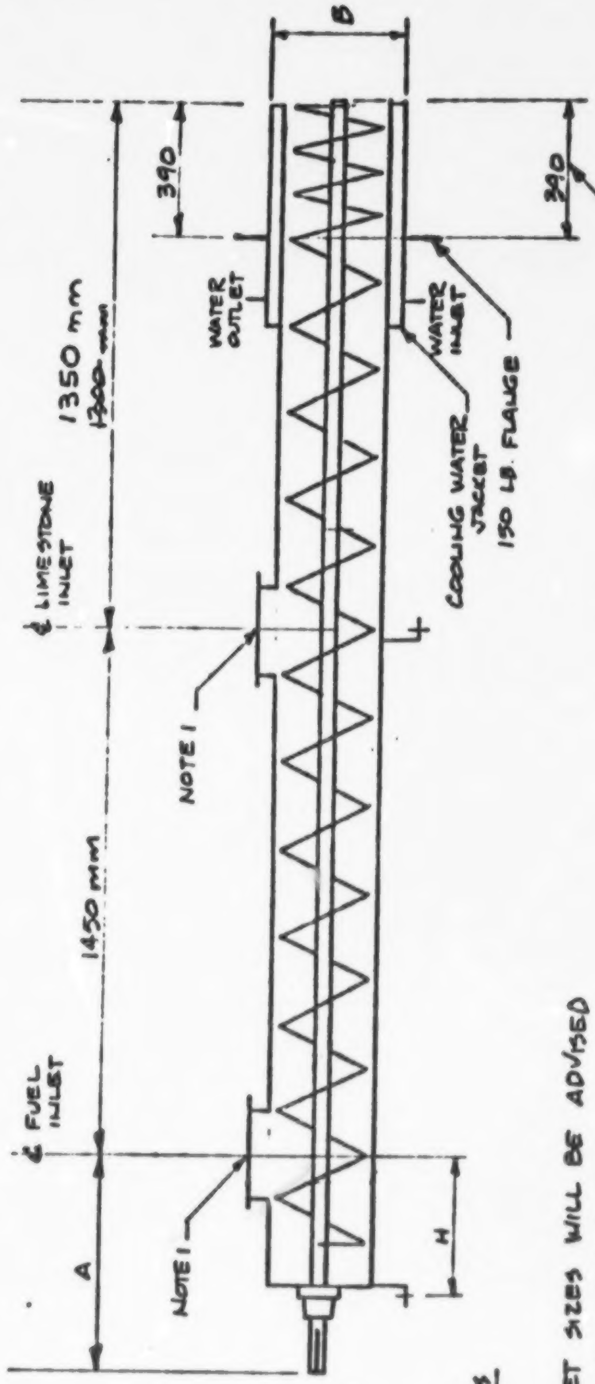
The screw is provided with 0'-7" long section of 304 stainless steel double flight complete with 14 GA. ST.ST. wrap over pipe (0'-7") and ST.ST. seal plate at end of pipe.

We use no flights rather than half pitch flights to effect a plugging seal. No end hanger used.

Drive end with the same arrangement as conveyor no. 1

3.0 DELIVERY

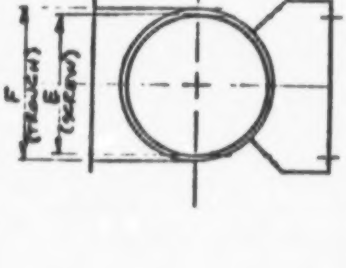
Time required for manufacture and shipment from receipt of order 2 months


B
390
390
1350 mm
~~1300 mm~~
WATER OUTLET
WATER INLET
℄ LIMESTONE INLET
COOLING WATER JACKET
150 LB. FLANGE
NOTE 1
1450 MM
℄ FUEL INLET
NOTE 1
A
H
DRIVE END

SCREW AND SHAFT IN THIS SECTION FABRICATED IN 310 STAINLESS STEEL

NOTES

1. INLET SIZES WILL BE ADVISED WHEN ORDER PLACED.


C
D
F (TROUGH)
E (SCREW)
G (SUPPORT)

THE BIDDER SHALL PROVIDE THE FOLLOWING DIMENSIONS:

A 590 mm
B 254
C 200
D 209
E 152
F 193
G 206 mm
H 190
COMBUSTOR FLANGE ______

ENERGY, MINES AND RESOURCES
CANADA

ATMOSPHERIC RECIRCULATING
FLUIDIZED BED COMBUSTOR
RESEARCH FACILITY

integ

SCALE	NTS	DATE
DRAWN		83-09-14
CHECK		

FUEL TRANSFER SCREW NO. 2
ARRANGEMENT

SHEET 1

5. INSTALLATION:

All of the equipment herein specified shall be installed by you and at your expense.

6. PAINTING:

Before shipment, we will apply one coat of paint to all shop fabricated, structural and plate work, and grease or oil all exposed finished machinery parts. If prime coat is to be other than our standard shop grey, it must be so stated in your bid specifications.

7. SAFETY DEVICES:

We shall not be required to furnish any safety devices or guards, required by law or otherwise, except those specified herein.

8. EQUIPMENT WARRANTY:

In lieu of all other warranties, express or implied, we warrant the equipment covered by this proposal, not manufactured by others, to be free from defects in material and workmanship under normal use and service, and when properly maintained. Use or service with corrosive or abrasive chemicals or materials shall not be deemed normal.

Our obligation under this warranty is limited to repairing at our factory or furnishing a replacement for any part or correcting at our factory, any workmanship which shall be demonstrated to our satisfaction to have been defective at the time of shipment and with respect to which a written claim specifying the particular defect or defects shall have been delivered to us within one (1) year from time of shipment or before the equipment has had twenty-one hundred (2100) hours of running use, whichever period is the shorter. Defective parts shall be returned to us F.O.B. our factory and repair or replacement parts shall be shipped by us F.O.B. our factory. We do not warrant equipment manufactured by others, but will submit to you upon request the manufacturer's warranty. We neither assume, nor authorize any other person to assume for us, any other liability in connection with the equipment covered by this proposal, including, without limiting the generality of the foregoing, liability for loss of production, product, equipment or profits and liability for consequential damages or any damages to persons or property. We will make no allowances for repairs, alterations or other work done unless specifically agreed to in writing.

9. PATENTS:

With respect to proposed equipment of our manufacture or design, we undertake to save you harmless from all judgement, decrees, costs and expenses resulting from any charge of infringement, of a Canadian patent issued prior to the date of this proposal, based upon the use or sale by you of any such proposed equipment in the form supplied by us and in the manner we recommend or in the manner in which such equipment is customarily used; provided that upon the receipt of any such charge of infringement by you, we are immediately notified in writing and are given complete control of the defense, with the right to defend, settle or make changes in such proposed equipment for the purpose of avoiding infringement; and it is mutually agreed that the obligation herein set forth is our only obligation with respect to patent infringement.

10. CHANGES AND DELAYS:

Should the work be delayed by you or for any other reason beyond our control, you will pay us for any loss, damage and additional expense suffered or incurred by us as a result of such delays.

In the event such delay involves a delay in shipment of the equipment, you will pay us the extra cost of storing and handling the equipment during the period of delay and if the delay in shipment exceeds forty-five (45) days from the date the equipment is ready for shipment, the entire purchase price plus the extra cost of storing and handling them accrued shall be due and payable forty-five (45) days after the date the equipment is ready for shipment and all charges subsequently accruing shall be due and payable at the end of each thirty (30) day period thereafter or upon shipment, whichever occurs first.

We reserve the right to make changes in design or material which in our judgement are for improvements in the equipment and/or its operation and which involve no change in the contract price. No other changes shall be made other than pursuant to written order signed by you and us setting forth the details and terms and conditions thereof (including changes in the delivery and/or installation schedule and in price, if any).

It is understood that a proper cancellation claim figured in accordance with this contract will be honored on the basis of expenses, costs and liabilities accumulated and/or incurred at the time of receipt at our main office of written notice of cancellation plus a reasonable cancellation charge to cover extra cost of handling and profit.

Delivery promises on all material are based on the present promises of our suppliers. All deliveries are subject to change as determined by Government restrictions and priorities and by actual deliveries by our suppliers.

11. ESCALATION:

The current economic instability makes it impossible to predict escalation reliably. Rather than burden the pricing with large built-in estimated allowances for possible escalation, our prices are based on current quotations from vendors, which are predicted on immediate shipment of the equipment.

The prices quoted hereinafter are all subject to escalation, based either upon escalation formulae utilizing Statistics Canada price indices, or upon actual price increases which are subject to verification by future audit.

To all price increases determined by either of the above methods shall be added our standard burdens and administrative expenses.

Vendor quotations used in this proposal shall serve as a base for any future escalation determination. These quotations will be made available to you at time of order.

Escalation involving Webb material or labour shall be substantiated by audit.

12. CLAIMS:

We will consider no claim for shortage or errors unless made immediately upon receipt of shipment. We are not to be held liable for delays, damage or loss due to shortage of materials, strikes, lockouts, differences with employees, accidents, fires, explosions, delays in manufacture, transportation or delivery of materials, acts of God, embargoes, inability to ship, inability to insure against war risks, Governmental action, or insurrection or any other causes beyond our control, whether the same as or different from the matters and things herein before specifically enumerated.

13. EXAMINATION AND TESTING:

In view of the special nature of conveying equipment, it is a physical impossibility to fabricate the order in our factory so that certain adjustments and minor alterations will not be necessary in the field after installation. This is particularly true on large jobs, or wherever two or more units must operate in conjunction. In such cases, we earnestly recommend that you avail yourself of the services of one of our skilled erection supervisors.

Should you so desire, we will provide for you the services of a competent person to superintend the installation and initial operation of the herein specified equipment; this offer is independent of other provisions of this proposal, and you shall reimburse us for our expense in the matter (weekly) (monthly) at the rate of $ ____________________ per eight (8) hour day, based upon the prevailing schedule of straight-time hours in the locality in which this installation is to be made. Additional charges will be made on the above schedule, for overtime, Saturday, Sunday, or holiday work, and for travel and living expenses of such person during the time he is away from our factory on your business.

14. USE OF SPECIFICATIONS AND DRAWINGS AND RESERVATION OF COPYRIGHTS:

We reserve all copyright rights in this proposal and in all accompanying specifications and drawings. This proposal and all such specifications and drawings are submitted to you solely for your consideration and in confidence, remain our property subject to recall by us, and are not to be published, reproduced, copied in whole or in part, loaned or otherwise communicated to any third party without our written permission. Drawings accompanying this proposal are not to be used for construction purposes.

15. TIME AND EFFECT OF ACCEPTANCE:

This proposal expires at our option unless acceptance be received at our main office within fifteen (15) days from the proposal date. This proposal is not an offer and its acceptance shall not constitute a contract unless and until such acceptance is approved at our main office by one of our officers or duly authorized representatives. Issuance of an order or acceptance of this proposal constitute acceptance of all conditions described herein.

16. PURCHASE PRICE AND TERMS OF PAYMENT:

The purchase price for the equipment herein specified is: —

$22,550.00

(Twenty-two thousand, five hundred and fifty dollars)

____________________ ($..........................)

payable in Canadian funds at par in Hamilton, Ontario as follows:

Federal, Provincial and Municipal taxes are extra where applicable.

Ninety percent (90%) cash for material as shipped, except as provided above in case of delays and shipment.

Balance thirty (30) days thereafter.

Overdue payments are to bear interest at the legal rate.

Terms of payment shall in no way be affected should the equipment be damaged or destroyed subsequent to transfer to carrier, by fire, the elements or by any other cause.

JERVIS B. WEBB COMPANY OF CANADA, LIMITED

C. D. Allman per J. E.

By C. D. Allman
Manager
Bulk Systems Division

APPROVED AT HAMILTON, ONTARIO:

Date ____________________

By ____________________

PURCHASERS ACCEPTANCE:

Date ____________________

Company ____________________

By ____________________

Proposal Number PB-83-780

Proposal Date: December 21, 1983

251-1

MATERIALS HANDLING GATES

251-1

BIDDER'S LIST

MATERIAL HANDLING GATES (251-1)

Effox, Inc.
P.O. Box 36270
Cincinnati, Ohio
45236

General Machine Co. of New Jersey, Inc.
55 Evergreen Ave.
Newark, N.J.
07114

251

SENT
FEB 10 1984

CIRC.	DATE
FILE	

‡
LYNUM ENG NWR

INTEG VCR
FOR LYNUM ENG SALES

FEB 10 1984 MSG 43

RE: MATERIALS HANDLING GATES

PLEASE ADVISE YOUR PRICE FOR THE FOLLOWING MANUALLY OPERATED GATES FOR A FLUIDIZED BED COMBUSTOR PILOT PLANT.

ITEM	SIZE (MM)	TEMP (DEG C)	PRESS (KPAG)	SERVICE	MAR.15.84 $US	PRICING $CDN
G1	100 DIA	260	20	SAND (NORMALLY CLOSED)	12,845.	16,700
G2	100 DIA	260	20	COAL AND SAND (NORMALLY OPEN)	12.600.	16,380
G3	100 DIA	260	35	SAND (NORMALLY CLOSED)	12,845.	16.700
G4	75 DIA	1000	45	HOT ASH (NORMALLY OPEN)	26,660.	34,658
G5	100 DIA	260	-2	WARM ASH (NORMALLY CLOSED)	12.845.	16,700

LOT - 101,138
DUTY @15% 15,171
TOTAL LOT 116,309

G3 AND G4 SEALING IS IMPORTANT. ALTHOUGH THE AREAS WILL BE PURGED WITH COOL AIR, HOT COMBUSTOR GASES SHOULD NOT LEAK PAST. G1 SEALING ALSO OF SOME IMPORTANCE. G4 MAY NORMALLY BE INSULATED FROM HIGH TEMPERATURE BY STATIC LAYER OF ASH.

STANDARD 150 LB BOLTING FLANGES TO BE PROVIDED.

PLEASE ADVISE RECOMMENDED MATERIAL OF CONSTRUCTION AND FLANGE FACE TO FACE DIMENSION.

REGARDS

G R COOPER
‡
LYNUM ENG NWR

INTEG VCR

PRICING FOB MIDDLESEX. NJ.
IN $US, TNIP
(EST. $CDN @ 1.30 $US.)

251

RECEIVED
FEB 27 1984
FILE

INTEG VCR
IVC CGY
2/27/84 8:20AM

INLAND VALVE CORP.

ATTN: G.R. COOPER
RE: YR INQ. OF FEB. 10TH MSG 43

WE ARE PLEASED TO OFFER THE FOLLOWING:

G1, G2, G3 + G5:

	EACH
4- 4'' HILTON NBR H200-R-T316 150LB WAFER BODY KNIFE GATE VALVE, C.S. BODY WITH 316SS WETTED PARTS, SPECIAL WEDGE C/W HANDWHEEL OP AND HIGH TEMP. PACKING	650.

G4:
--

1- 3'' HILTON NBR H200-R-SYT316 150LB WAFER BODY KNIFE GATE VALVE, 316SS CONSTRUCTION, SPECIAL WEDGE, C/W HANDWHEEL OP AND HIGH TEMP CERAMIC PACKING	728.

NOTES: (1) DUE TO TEMPERATURES INVOLVED, VALVES MUST HAVE METAL TO METAL SEATING WHICH WILL NOT PROVIDE ZERO LEAKAGE. HOWEVER, LEAKAGE WOULD BE VERY SLIGHT

(2) IF ABRASION IS A CONCERN, SEATS COULD BE SUPPLIED WITH HIGHER BRINNELL HARDNESS OR STELLITED SEATS ARE AVAILABLE.

DELIVERY: 5-6 WKS
FOB: EDMONTON
TAXES NOT INCLUDED
NET 30 DAYS

REGARDS
PETER SMIGEL
IVC CGY

251

GEMCO

GENERAL MACHINE COMPANY OF NEW JERSEY, INC.

55 EVERGREEN AVENUE NEWARK, N. J. 07114
(201) 242-7405 Telex – 139207

March 15, 1984

mleg
MAR 21 1984
FILE

International Engineering Ltd.
1151 West Pender Street
Vancouver, B.C. V6E 2P4

Attention: Mr. G. Coopere

Reference: Gemco Proposal No.: 3-1584

Gentlemen:

In accordance with your request, we are pleased to offer the following proposal:

One (1) G1 Gemco Type "T" Valve 316 stainless steel.

Price each	$12,845.00 U.S. Funds

One (1) G2 Gemco Type "T" Valve 316 stainless steel.

Price each	$12,600.00 U.S. Funds

One (1) G3 Gemco Type "T" Valve 316 stainless steel.

Price each	$12,845.00 U.S. Funds

One (1) G4 Gemco Type "T" Valve Hastelloy C.

Price each	$26,660.00 U.S. Funds

One (1) G5 Gemco Type "T" Valve 316 stainless steel.

Price each	$12,845.00 U.S. Funds

All 4" Valves face to face 8-1/4".
All 3" Valves face to face 5-1/2".

All Prices are, f.o.b. Middlesex, New Jersey:

863

GEMCO CONICAL BLENDERS • VACUUM DRYERS • SPHERICAL VALVES
GEMCOMATIC DRUM LOADING SYSTEMS • FORMULATORS • PORTA/BLENDER SYSTEMS

251

International Engineering Ltd.
Mr. G. Coopere

March 15, 1984

Shipment would take approximately 16-18 weeks after receipt of order or approval drawings.

We sincerely appreciate your interest in our equipmetn and hope to have the pleasure of serving you in the near future. Should you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,

GEMCO * New Jersey

William J Muench

William J. Muench
Director of Valve Products

WJM/mb

enc: lit.

cc: Armstrong Jones Ltd.
Masdom Corp. Ltd.
83 Sunrise Ave.
Toronto, Ontario M4A 1B1
Canada

2J1

Proposal No.: 3-1584

FTC-80

Proposal Date: 3/15/84

G E M C O - N. J.

(The General Machine Company of New Jersey)

TERMS AND CONDITIONS

All selling prices quoted are subject to change without notice after thirty (30) days from date of proposal unless specified otherwise.

Unless otherwise stated all prices are F.O.B. GEMCO'S factory or it's suppliers shipping points.

PAYMENT TERMS

Net payment in full on all invoices is due thirty (30) days after shipment unless otherwise stated.

In the event total price exceeds Seventy-five Thousand Dollars ($75,000.00) progress payments shall be requested, due and payable prior to shipment to cover engineering costs, material purchases and completion of order under the following schedule:

Twenty percent (20%) payment shall be submitted upon receipt of final certified drawings.

Thirty percent (30%) payment shall be due and payable on notice from Gemco that materials for order have been received.

Forty percent (40%) payment shall be due and payable on notice from Gemco that order has been completed and ready for final testing or shipment.

Balance of payment shall be due and payable thirty (30) days after shipment. Any account unpaid after final shipment is subject to a service charge of one and one-half percent (1½%) per month on unpaid balance.

Modifications or Revisions made to the original equipment resulting in a price change in the initial purchase order will be added to our invoice at time of shipment.

252-1
FLUE GAS DAMPERS

252-1

BIDDER'S LIST

FLUE GAS DAMPERS (252-1)

Effox Inc.
P.O. Box 36270
Cincinatti, Ohio
45236

Olympic International Agencies
145 Riverside Drive
North Vancouver, B.C.
V7H 1T6

EFFOX

Effox, Inc.

P.O.Box 36270
Cincinnati, Ohio 45236
Telex #24-1478
513/793-1932

March 1, 1984

Mr. G. R. Cooper

INTERCONTINENTAL ENGINEERING
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

integ
MAR - 8 1984
DATE
GRC

Re: Request for Quotation
Dampers
Effox, Inc. Proposal #02294A

Dear Mr. Cooper:

Effox, Inc. would like to clarify that our prices in our proposal #02294A sent to you on February 29, 1984 are in U.S. dollars.

Thank you.

Sincerely,

EFFOX, INC.

Peggy L. Torbeck
Peggy L. Torbeck

PLT/ms

cc: Mr. Thor Lynum/Lynum Engineering Sales

EFFOX

Effox, inc.

P.O.Box 36270
Cincinnati, Ohio 45236
Telex #24-1478
513/793-1932

February 29, 1984

integ
MAR - 9 1984
GRC
FILE

Mr. G. R. Cooper

INTERCONTINENTAL ENGINEERING
1155 West Pender Street
Vancouver, B.C.
V6E 2P4

Re: Request for Quotation
Dampers
Effox, Inc. Proposal #02294A

Dear Mr. Cooper:

EFFOX, INC. is pleased to submit this proposal for your damper requirements. The machinery offered in this proposal is of the highest quality and specifically designed for the system parameters detailed in the project specifications.

We reserve the right to substitute component parts of equivalent quality.

We have attempted to provide as much information as possible; however if you have any questions or require additional information, please feel free to contact us.

We look forward to working with you on this project. Thank you for your time and consideration.

Sincerely,

EFFOX, INC.

Terry Gillespie

R. Terry Gillespie
Proposal Engineer

RTG/plt

cc: Mr. Thor Lynum/Lynum Engineeering Sales
604-591-7848

Design Conditions, Construction Features & Pricing

Item:	D1
Quantity:	One (1)
Size:	200 Diameter
Type:	Wafer
Pressure:	2 KPAG
Temperature:	1,100 Deg. C./177 Deg. C.
Flow:	625 acfm
Housing:	3/16" Plate 330 S.S.
Flanges:	3/16" Plate with (8) 7/8" Ø Holes on 11-3/4" B.C.
Blade:	1/4" Plate 330 S.S.
Shaft:	1" Ø 330 S.S.
Seals:	Tadpole
Bearings:	Sleeve
Paint:	Mill Finish
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	100 lbs.
Net Price/Each:	$2,240.00

Design Conditions, Construction Features & Pricing

Item:	D2
Quantity:	One (1)
Size:	300 Diameter
Type:	Wafer
Pressure:	2 KPAG
Temperature:	1,100 Deg. C./177 Deg. C.
Flow:	1,250 acfm
Housing:	3/16" Plate 330 S.S.
Flanges:	3/16" Plate with (12) 1" Ø Holes on 17" B.C.
Blade:	1/4" Plate 330 S.S.
Shaft:	1" Ø 330 S.S.
Seals:	Tadpole
Bearings:	Sleeve
Paint:	Mill Finish
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	125 lbs.
Net Price/Each:	$2,390.00

Design Conditions, Construction Features & Pricing

Item:	D3
Quantity:	One (1)
Size:	200 Diameter
Type:	Wafer
Pressure:	2 KPAG
Temperature:	260 Deg. C./177 Deg. C.
Flow:	625 acfm
Housing:	3/16" Plate ASTM-A36
Flanges:	3/16" Plate ASTM-A36 with (8) 7/8" Ø Holes on 11-3/4" B.C.
Blade:	1/4" Plate ASTM-A36
Shaft:	1" Ø ASTM-A108
Seals:	Tadpole
Bearings:	Ball
Paint:	One Shop Coat Primer
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	100 lbs.
Net Price/Each:	$1,475.00

Design Conditions, Construction Features & Pricing

Item:	D4
Quantity:	One (1)
Size:	200 Diameter
Type:	Wafer
Pressure:	6 KPAG
Temperature:	260 Deg. C./177 Deg. C.
Flow:	1,250 acfm
Housing:	3/16" Plate ASTM-A36
Flanges:	3/16" Plate ASTM-A36 with (8) 7/8" Ø Holes on 11-3/4" B.C.
Blade:	1/4" Plate ASTM-A36
Shaft:	1" Ø ASTM-A108
Seals:	Tadpole
Bearings:	Ball
Paint:	One Shop Coat Primer
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	100 lbs.
Net Price/Each:	$1,475.00

Design Conditions, Construction Features & Pricing

Item:	D5
Quantity:	One (1)
Size:	250 Diameter
Type:	Wafer
Pressure:	6 KPAG
Temperature:	260 Deg. C./177 Deg. C.
Flow:	1,250 acfm
Housing:	3/16" Plate ASTM-A36
Flanges:	3/16" Plate ASTM-A36 with (12) Ø Holes on 14-1/4" B.C.
Blade:	1/4" Plate ASTM-A36
Shaft:	1" Ø ASTM-A108
Seals:	Tadpole
Bearings:	Ball
Paint:	One Shop Coat Primer
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	110 lbs.
Net Price/Each:	$1,515.00

Design Conditions, Construction Features & Pricing

Item:	D6
Quantity:	One (1)
Size:	200 Diameter
Type:	Wafer
Pressure:	6 KPAG
Temperature:	260 Deg. C./177 Deg. C.
Flow:	625 acfm
Housing:	3/16" Plate ASTM-A36
Flanges:	3/16" Plate ASTM-A36 with (8) 7/8" Ø Holes on 11-3/4" B.C.
Blade:	1/4" Plate ASTM-A36
Shaft:	1" Ø ASTM-A108
Seals:	Tadpole
Bearings:	Ball
Paint:	One Shop Coat Primer
Actuator:	Manual Timpco Gearbox with Chainwheel and 4m of Chain
Leakage:	2% Maximum
Weight/Each:	100 lbs.
Net Price/Each:	$1,475.00

252

Delivery Schedule

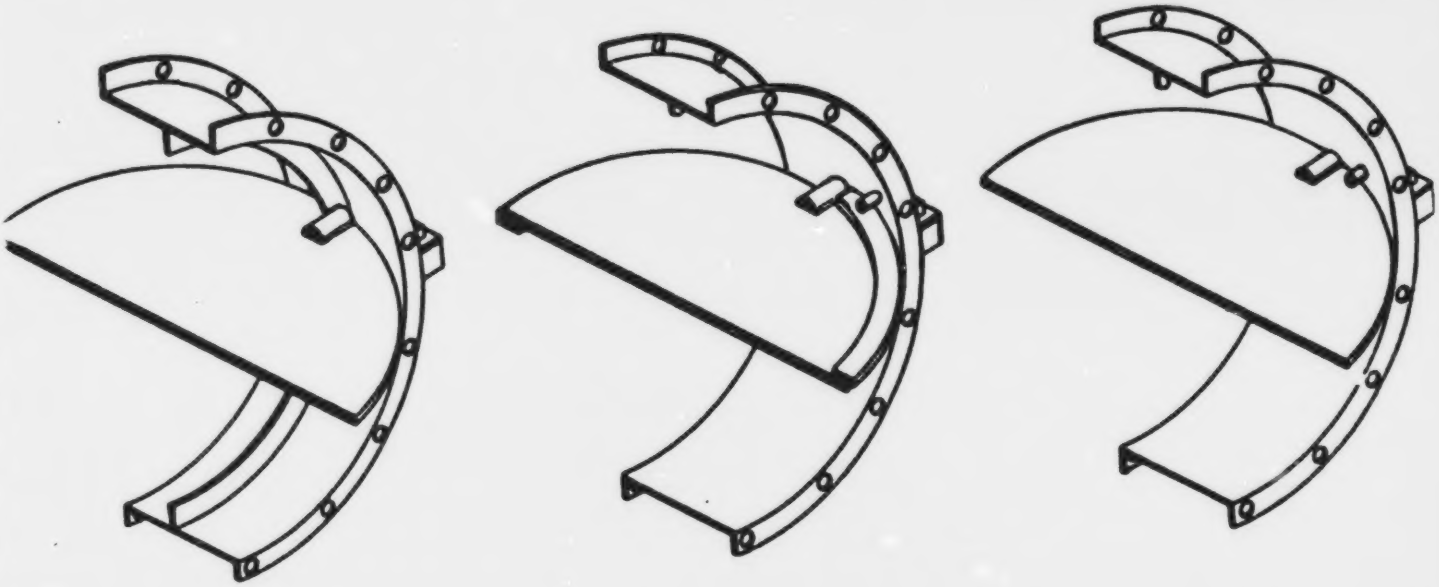
Prices quoted are valid for acceptance within sixty (60) days from this date, FOB Factory with no freight included or allowed.

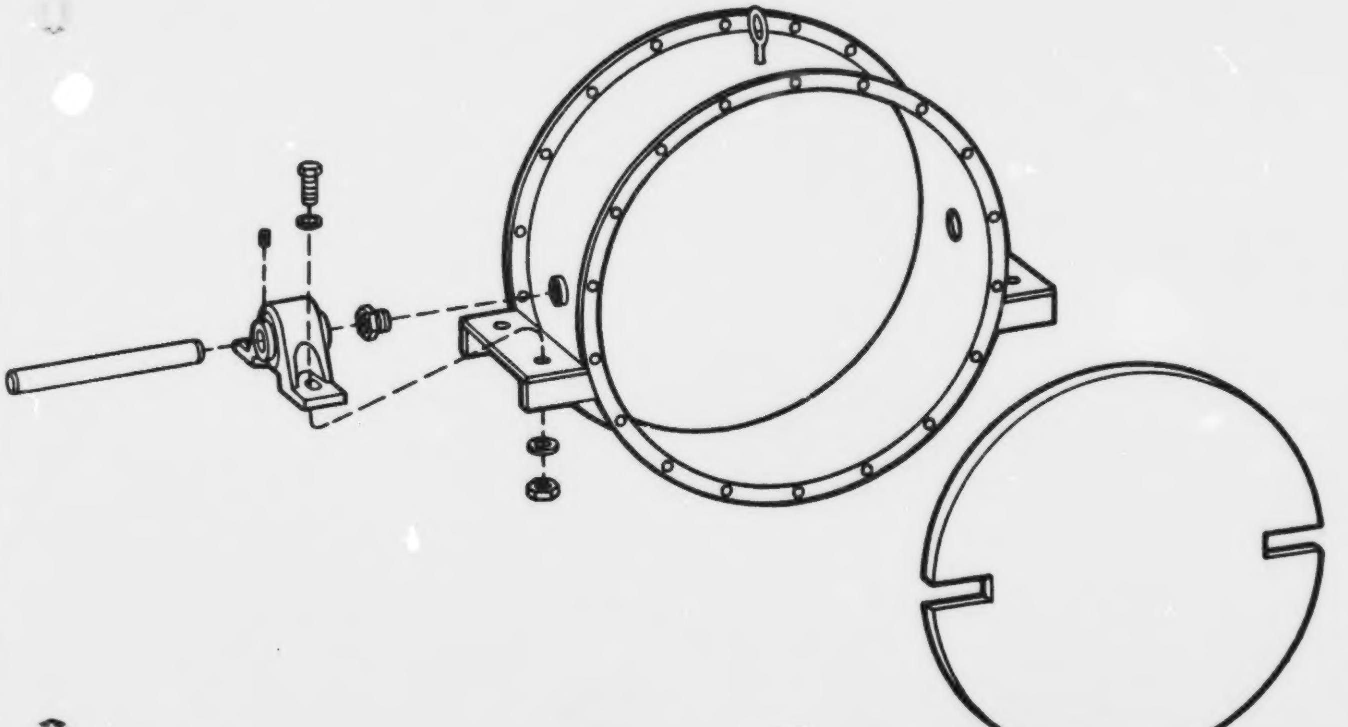
Submittal drawings can be mailed within seven (7) working days after receipt of your written purchase order.

Dampers can be shipped within ten (10) to twelve (12) weeks after receipt of unqualified approved submittal drawings.

DAMPER DETAIL SHEET **13**

WAFER DAMPER





Effox Inc.
P.O. Box 36270 Cincinnati, Ohio 45236

513·793·1932
TELEX # 24·1478

TERMS AND CONDITIONS

TERMS: 1½% ten (10) days, net thirty (30) days from this date of invoice, unless otherwise specified in quotation document. The terms listed are general terms for the sales of goods or services only. (See freight for payment of freight invoices.)

LATE PAYMENT CHARGES: A 1½% monthly service charge will be added to your account on invoices not paid within our net thirty (30) day terms.

PRICES: All prices are F.O.B. Seller's plant and do not include any applicable Federal, State, Local Sales or Excise Taxes or other surcharges unless specifically indicated.

PAYMENTS: Remittances should be made to Effox, Incorporated, P.O. Box 36270, Cincinnati, Ohio 45236. If the financial condition or credit of the Buyer at any time shall, in the judgement of the Seller, not warrant shipment of products ordered, the Seller may at its option require full payment prior to shipment or refuse to ship.

DESIGN: The Seller reserves the right to make design improvements without notice.

WARRANTY: The Seller warrants its product against defects in material or workmanship, when used on those services approved by the Seller, for a period of one (1) year from date of original shipment. The Seller's liability under this warranty shall be limited to repair or replacement at Seller's option of such defective products, F.O.B. Factory, upon proof of defect satisfactory to Seller. Seller shall have no further liability for damages of any kind, including but not limited to personal injuries and property damage, resulting from use of Seller's product. **This warranty is expressly in lieu of all other warranties, either expressed or implied, unless agreed to in writing by an authorized officer of the Seller.**

CANCELLATION: The Buyer may cancel upon the written consent of the Seller, but the Seller is entitled to reasonable cancellation charges including but not limited to labor expended, materials obtained or expended and reasonable overhead expenses.

SPECIAL AND CONSEQUENTIAL DAMAGES: In no event shall Seller be liable for any consequential or special damages arising from any breach of these terms and conditions.

SHIPMENT AND DELIVERY: Shipment dates are based on the Seller's best estimates only. The Seller will exercise his best efforts to ship on schedule, but shall not be liable for any damages or loss caused by any delay in delivery, including but not limited to delay caused by strikes, floods, fires, accidents, inability to obtain sufficient materials or products from suppliers, inability to obtain sufficient labor, or any legislative, adminstrative or executive law, order, or requisition of the Federal Government of any State or Municipal Government or any subdivision, department or office thereof. The responsibility of goods lost or damaged in transit rests with the carrier.

MODIFICATION OF ADDITION OF TERMS AND CONDITIONS: No modification of, addition to, or waiver, of any of the terms and conditions stated herein shall be binding upon the Seller, except by the written consent of an authorized officer of the Seller.

ACCEPTANCE: Any order by the Buyer placed pursuant to a quotation is subject to acceptance and acknowledgement by Seller in Cincinnati, Ohio. If Buyer accepts any portion of the merchandise ordered, he will be deemed to have assented to the terms and conditions stated herein.

CLAIMS: All claims for corrections or deductions must be made within ten (10) days after delivery of goods.

FREIGHT: On Prepaid & Add Freight Invoices the freight charge must be paid within seven (7) days as required by the Interstate Commerce Commission.

252

RE[illegible] VED
FEB 01 1984
DATE
FILE

JIAGENCIES VCR
NOV 1/84

ATTN: G.R. COOPER

RE: UR TLX REQUEST FOR DAMPER QUOTATION V12/JAN/84

ITEM	SIZE MM	PRICE (DOLLARS)
D1	200	2,120.00
D2	300	2,780.00
D3	200	785.00
D4	200	785.00
D5	250	875.00
D6	200	785.00

D1 AND D2 ARE VERY SPECIAL HIGH TEMP BUTTERFLIES WITH DISHED TYPE REFRACTORY DISC

ALL PRICES ARE F.O.B. BETHLEHEM, PA
ALL VALUES ARE IN U.S. DOLLARS

REGARDS,
BOB NORCROSS
OLYMPIC INTERNATIONAL AGENCIES

+[illegible]
INTEG VCR

7

253-1

EXPANSION JOINTS

Volume

4

ENERGY, MINES AND RESOURCES. CANADA
CANMET / CCRL

DESIGN OF AN ATMOSPHERIC RECIRCULATING FLUIDIZED BED COMBUSTION RESEARCH FACILITY

Work on this project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources, Canada.

DSS FILE NUMBER : 15SQ.23440-2-9141
DSS CONTRACT SERIAL NUMBER : OSQ82-00224
CANMET SCIENTIFIC AUTHORITY : D. Desai

VOLUME IV
DRAWINGS

272pp

JULY 1984

MICROMEDIA
FEB 27 1985

GA Technologies

884

integ
Intercontinental Engineering Ltd.

integ
Intercontinental Engineering Ltd.

14 September 1984
File: 0243-K1

Mr. D. Desai
Combustion & Carbonization
Research Laboratory
CANMET, Energy Research Labs.
Dept. of Energy, Mines & Resources
555 Booth St.
Ottawa, Ontario
K1A 0G1

Dear Sir:

Re: Final Report
ARFBC Research Facility Design
Contract Serial No. OSQ82-00224
DSS File No. 15SQ.23440-2-9141

We are pleased to submit herewith five (5) copies of our final report for the above contract. The report was prepared by INTEG-Intercontinental Engineering Ltd. and GA Technologies in accordance with the scope of work set out in Contract OSQ82-00224 and Amendments dated August 15, 1983 and March 1, 1984.

A draft report was presented in August, 1984 and most of the material has also been issued as milestone reports.

The report comprises four volumes, identified as follows:

Volume I	-	Design Report
Volume II	-	Equipment Specifications
Volume III	-	Bidders lists and Equipment Suppliers Quotations
Volume IV	-	Drawings

All drawings produced for this contract are included in Volume IV in reduced form for convenient reference, and the major drawings are included as well in Appendix II of Volume I for added convenience.

The design report includes a section which details the further work required to complete the procurement and final engineering of the facility. A recommended staged purchasing program is described which will facilitate the final engineering and minimize procurement delays.

1155 West Pender St., Vancouver, B.C., Canada V6E 2P4 / Tel. (604) 682-7841 / Telex: 04-51296 / Cables: Vaninteg Vancouver

This report describes the second phase of the design of the ARFBC research facility. The first phase, prepared by others, was a conceptual design study. This phase encompasses the first part of the detailed engineering and includes development of the design to the tender stage and preparation of a detailed cost estimate. The information and drawings contained in this report are all subject to revision following procurement and receipt of certified equipment drawings and specifications.

We trust you will find the contents of the report to your satisfaction and will be pleased to offer any further assistance on this project.

Yours very truly,

INTEG-Intercontinental Engineering Ltd.

G.R. Cooper, P.Eng.
Project Manager

GRC/mt
c.c. E. Fresque D.S.S.

DESIGN REPORT

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DESIGN REPORT

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4.14 Building and Structure 4 - 14

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5.1 Scope 5 - 1
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5.3 Start-up 5 - 3
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APPENDIX II - LAYOUT AND ARRANGEMENT DRAWINGS

APPENDIX III - LOOP SEAL VERIFICATION TEST REPORT

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APPENDIX V - EQUIPMENT SPECIFICATIONS

VOLUME III

APPENDIX VI - BIDDERS' LISTS AND SUPPLIERS' EQUIPMENT QUOTATIONS

VOLUME IV

DRAWINGS

VOLUME IV

DRAWING LIST

DRAWINGS

DRAWING LIST

Drawing Number	Title
G.A. Technologies	
3100-001	Combustor Assembly
3100-002	Combustor Bottom Subassembly
3100-003	Distributor Plate
3100-004	Combustor Top Subassembly
3100-005	Bayonet Tube
3100-006	Combustor L-Valve Subassembly
Mechanical	
AO-0243-4601	Process and Instrumentation Diagram
AO-0243-4701	General Arrangement - Ground Floor and Platform El. 2300
AO-0243-4702	General Arrangement - Platform El. 4700 and 7700
AO-0243-4703	General Arrangement - Section A
AO-0243-4704	General Arrangement - Section B
AO-0243-4705	General Arrangement - Section C and D
AO-0243-4706	General Arrangement - Penthouse and Bayonet Tube Removal System
AO-0243-4707	General Arrangement - Cooling Water System, F.D. Fan, Stack and Blowers
AO-0243-4801	Piping Arrangement - Ground Floor and Platform El. 2300
AO-0243-4802	Piping Arrangement - Platform El. 4700 and 7700
AO-0243-4803	Piping Arrangement - Section A
AO-0243-4804	Piping Arrangement - Section C and D
B-0243-SK231-2	Fuel Loading and Feed Chutes
B-0243-SK172-1	Flue Gas Breeching - Refractory Lined Duct Section
Electrical	
A1-0243-6101	One Line Diagram
A1-0243-6201	Block Diagram - Power and Control
A1-0243-6202	Block Diagram - Instrumentation
A1-0243-7301	Schematic Diagrams
A-0243-7601	Motor List - Sheet 1 of 2
A-0243-7602	Motor List - Sheet 2 of 2

Drawing Number	Title
Instrumentation	
B-0243-8101	Logic Diagrams - Symbols and Definitions
B-0243-8102	Logic Diagrams - I.D. Fan, Circulating Water Pump, Cooling Tower Pump, Bucket Elevator, Limestone Separator Rotary Valve, Limestone Blower
B-0243-8103	Logic Diagrams - Transfer Conveyors No. 1 and 2, Feed Chute Rotary Valve, Bed Drain Cooler, Baghouse Rotary Valve
B-0243-8104	Logic Diagrams - F.D. Blower, Fuel Bin Activator, Master Trip
B-0243-8105	Logic Diagrams - Weighfeeder and Weighfeeder Discharge Rotary Valve
A-0243-8301-002	Loop Diagram - Combustor Air Header Pressure
A-0243-8301-003	Loop Diagram - Combustor Air Header Temperature
A-0243-8301-004	Loop Diagram - Total Air to Combustor - Flow
A-0243-8301-007	Loop Diagram - Primary Air - Flow
A-0243-8301-008	Loop Diagram - Primary Air - Windbox Pressure
A-0243-8301-009	Loop Diagram - Secondary Air Before Flow Element - Pressure
A-0243-8301-010	Loop Diagram - Secondary Air - Flow
A-0243-8301-017	Loop Diagram - Loop Seal Air - Flow
A-0243-8301-018	Loop Diagram - Flyash Recycle Air - Flow
A-0243-8301-021	Loop Diagram - Fuel Bin - Level
A-0243-8301-022	Loop Diagram - Fuel Bin - Level
A-0243-8301-023	Loop Diagram - Fuel to Combustor - Flow
A-0243-8301-024	Loop Diagram - Fuel Feeder - Flow
A-0243-8301-025	Loop Diagram - Limestone Bin - Level
A-0243-8301-026	Loop Diagram - Limestone Bin - Level
A-0243-8301-027	Loop Diagram - Limestone to Combustor - Flow
A-0243-8301-028	Loop Diagram - Limestone Feeder - Flow
A-0243-8301-030-042	Loop Diagram - Combustor Temperatures - Sheet 1
A-0243-8301-030-042	Loop Diagram - Combustor Temperatures - Sheet 2
A-0243-8301-043	Loop Diagram - Fluidized Bed (Above Distributor) Pressure

Drawing Number	Title
A-0243-8301-051	Loop Diagram - Combustor - Pressure
A-0243-8301-052	Loop Diagram - Combustor - Pressure
A-0243-8301-053	Loop Diagram - Combustor Outlet Duct to Cyclone - Temperature
A-0243-8301-055	Loop Diagram - Cyclone - Temperature
A-0243-8301-057	Loop Diagram - Recycle Loop Before Aeration Ports - Temperature
A-0243-8301-060	Loop Diagram - Recycle Loop After Aeration Ports - Temperature
A-0243-8301-062	Loop Diagram - Cyclone Gas Outlet - Pressure
A-0243-8301-063	Loop Diagram - Cyclone Gas Outlet - Temperature
A-0243-8301-064	Loop Diagram - Distributor - Differential Pressure
A-0243-8301-065	Loop Diagram - Fluidized Bed Base to Combustor Outlet - Differential Pressure
A-0243-8301-066	Loop Diagram - Flue Gas Cooler Outlet - Pressure
A-0243-8301-067	Loop Diagram - Flue Gas Cooler Outlet - Temperature
A-0243-8301-068	Loop Diagram - Flue Gas Cooler Outlet - Temperature
A-0243-8301-070	Loop Diagram - Baghouse Flue Gas - Differential Pressure
A-0243-8301-072	Loop Diagram - I.D. Fan Gas Inlet - Temperature
A-0243-8301-074	Loop Diagram - Cooling Tower Remote Sump - Makeup Water Temperature
A-0243-8301-075	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-076	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-079	Loop Diagram - Cooling Tower Water at Heat Exchanger Inlet - Temperature
A-0243-8301-080	Loop Diagram - Cooling Tower at Heat Exchanger Outlet - Temperature
A-0243-8301-083	Loop Diagram - Plant Cooling Water Header - Temperature
A-0243-8301-085	Loop Diagram - Plant Cooling Water Header - Pressure
A-0243-8301-086	Loop Diagram - Plant Cooling Water Header - Pressure
A-0243-8301-087	Loop Diagram - Plant Cooling Water at Heat Exchanger Inlet - Temperature

Drawing Number	Title
A-0243-8301-088	Loop Diagram - Plant Cooling Water at Heat Exchanger Outlet - Temperature
A-0243-8301-089	Loop Diagram - Plant Cooling Water to Flue Gas Cooler - Flow
A-0243-8301-091	Loop Diagram - Plant Cooling Water at Flue Gas Cooler Outlet - Temperature
A-0243-8301-092	Loop Diagram - Plant Cooling Water at Bed Drain Cooler Outlet - Temperature
A-0243-8301-096	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 1 - Flow
A-0243-8301-097	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 1 - Temperature
A-0243-8301-098	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 2 - Flow
A-0243-8301-099	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 2 - Temperature
A-0243-8301-100	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 3 - Flow
A-0243-8301-101	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 3 - Temperature
A-0243-830[illegible]-102	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 4 - Flow
A-0243-8301-103	Loop Diagram - Plant Cooling Water to Bayonet Tube No. 4 - Temperature
A-0243-8301-104	Loop Diagram - Plant Cooling Water from Bayonet Tubes - Temperature
A-0243-8301-108	Loop Diagram - Plant Cooling Water from Trans. Conv. No. 2 - Temperature
A-0243-8301-111	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 1 - Flow
A-0243-8301-112	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 2 - Flow
A-0243-8301-113	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 3 - Flow
A-0243-8301-114	Loop Diagram - Plant Cooling Water from Bayonet Tube No. 4 - Flow
A-0243-8301-118	Loop Diagram - Cyclone Outlet to Recycle Loop - Diff. Pressure
A-0243-8301-120	Loop Diagram - Baghouse Flue Gas - Diff. Pressure
A-0243-8301-121	Loop Diagram - Cooling Tower Remote Sump - Level
A-0243-8301-123	Loop Diagram - Combustor Average Temperature

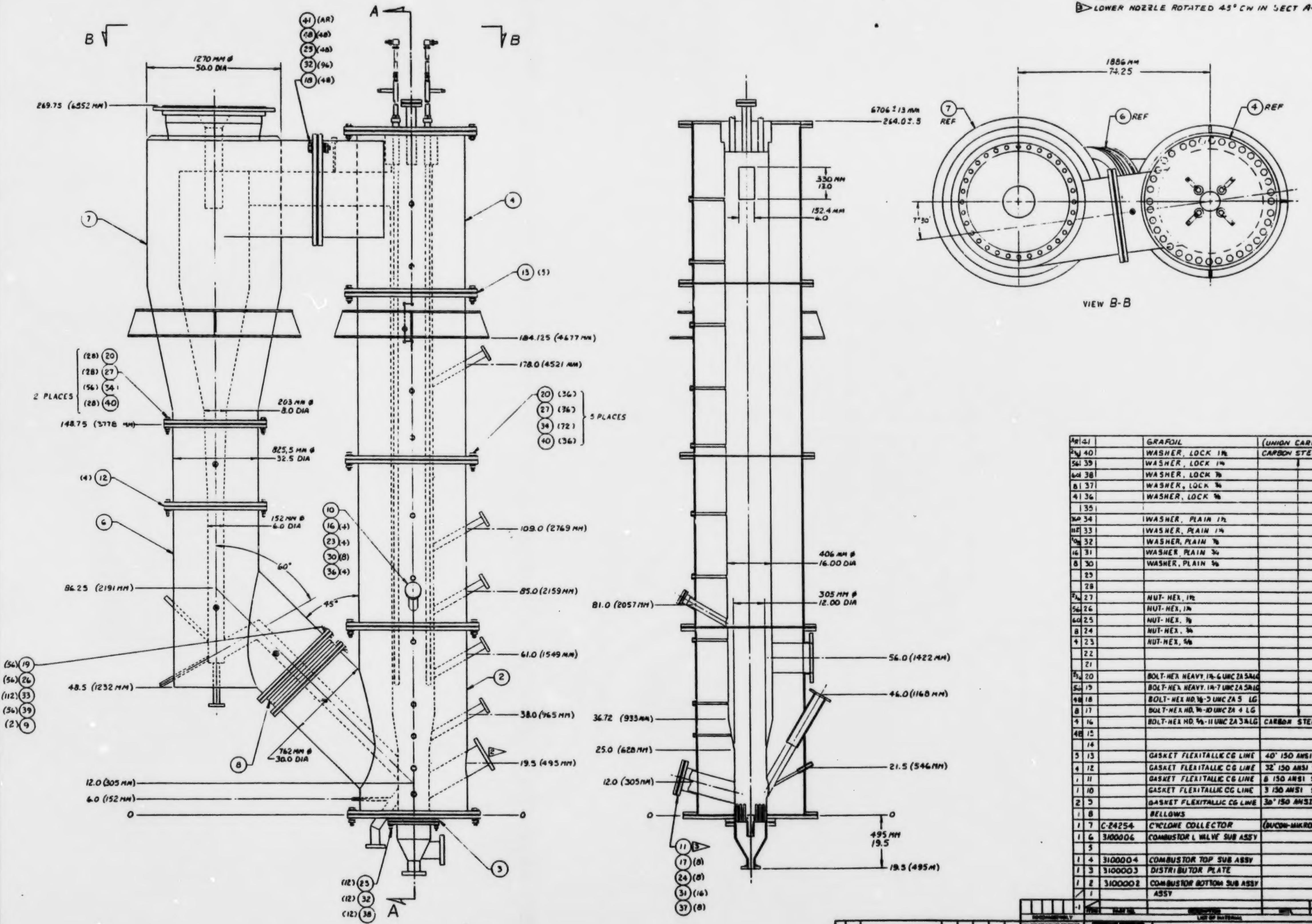
Drawing Number	Title
A-0243-8301-124	Loop Diagram - Flyash Recycle/Disposal (3 Way Valve) Control
A-0243-8301-200	Loop Diagram - Combustion Control (Energy Input Demand)
A-0243-8401	Instrument List (46 Sheets)
A-0243-8501	Annunciator Layout
A-0243-8601	Data Logger I/O List
A-0243-8602	Data Logger I/O List
A-0243-8701	Specification Sheet - Control Valves
A-0243-8702	Specification Sheet - Control Valves
A-0243-8703	Specification Sheet - Control Valves
A-0243-8704	Specification Sheet - Control Valves
A-0243-8705	Specification Sheet - Flow Elements
A-0243-8706	Specification Sheet - Flow Elements
A-0243-8707	Specification Sheet - Flow Elements
A-0243-8708	Specification Sheet - Flow Elements
A-0243-8709	Specification Sheet - Flow Transmitters
A-0243-8710	Specification Sheet - Flow Transmitters
A-0243-8711	Specification Sheet - Flow Transmitters
A-0243-8712	Specification Sheet - Rotometers
A-0243-8713	Specification Sheet - Pressure Transmitters
A-0243-8714	Specification Sheet - Pressure Transmitters
A-0243-8715	Specification Sheet - Pressure Transmitters
A-0243-8716	Specification Sheet - Temperature Transmitters
A-0243-8717	Specification Sheet - Temperature Transmitters
A-0243-8718	Specification Sheet - Thermocouple Assemblies
A-0243-8719	Specification Sheet - Temperature Controller
A-0243-8720	Specification Sheet - Level Controller
A-0243-8721	Specification Sheet - Level Gauge (Glass)
A-0243-8722	Specification Sheet - Pressure Controller
A-0243-8723	Specification Sheet - Pressure Switches

Drawing Number	Title
A-0243-8724	Specification Sheet - Temperature Switches
A-0243-8725	Specification Sheet - Pressure Gauges
A-0243-8726	Specification Sheet - Pressure Gauges
A-0243-8727	Specification Sheet - Temperature Gauges
A-0243-8728	Specification Sheet - Level Switch
A-0243-8729	Specification Sheet - Flow Switches
A-0243-8730	Specification Sheet - Purge Meters
A-0243-8731	Specification Sheet - Pressure Regulator
A-0243-8732	Specification Sheet - Indicators
A-0243-8733	Specification Sheet - Indicators
A-0243-8734	Specification Sheet - Indicators
A-0243-8735	Specification Sheet - Recorders
A-0243-8736	Specification Sheet - Temperature Transmitters
A-0243-8738	Specification Sheet - Annunciator
A-0243-8739	Specification Sheet - Rotameters
A-0243-8740	Specification Sheet - Rotameters
A-0243-8741	Specification Sheet - Loop Power Supply
A-0243-8742	Specification Sheet - Controllers (3 Sheets)
A-0243-8743	Specification Sheet - Manual Station
A-0243-8801	Installation Details - Purged Pressure Tapping Point
A-0243-8802	Installation Details - Thermowell Installation in Small Size Lines
A-0243-9001	Shared Controller I/O List - Inputs (UIC-1)
A-0243-9002	Shared Controller I/O List - Outputs (UIC-1)
A-0243-9003	Shared Controller I/O List - Inputs (UIC-2)
A-0243-9004	Shared Controller I/O List - Outputs (UIC-2)
A-0243-9005	Shared Controller I/O List - Inputs (UIC-3)
A-0243-9006	Shared Controller I/O List - Outputs (UIC-3)
B-0243-9201	Instrument Schematic - Air System
B-0243-9202	Instrument Schematic - Fuel System and Combustion Control

Drawing Number	Title
B-0243-9203	Instrument Schematic - Combustor and Flue Gas System
B-0243-9204	Instrument Schematic - Plant Cooling System
B-0243-9401	Control Panel Layout
B-0243-9402	Control Panel Layout - Details
B-0243-9403	Control Panel Layout - Details
Civil/Structural	
AO-0243-3801	Structural Layout - Platforms and Roof Plan
AO-0243-3802	Structural and Architectural Elevations and Details
AO-0243-3803	Structural - Miscellaneous Details
AO-0243-3804	Foundation Plan and Details

G.A. TECHNOLOGIES

NOTES:
1. ALL DIMENSIONS ON THIS DWG ARE FOR REF ONLY.
2▷ IGNITER PORT FINAL DIMENSIONS SHALL BE SUPPLIED BY INTEG.
3▷ LOWER NOZZLE ROTATED 45° CW IN SECT A-A.



A
B
B
1270 MM ϕ
50.0 DIA
269.75 (6852 MM)
41 (AR)
18 (48)
25 (48)
32 (96)
18 (48)
7
4
13 (5)
184.125 (4677 MM)
178.0 (4521 MM)
2 PLACES
(28) 20
(28) 27
(56) 34
(28) 40
203 MM ϕ
8.0 DIA
148.75 (3778 MM)
20 (36)
27 (36)
34 (72)
40 (36)
5 PLACES
825.5 MM ϕ
32.5 DIA
(4) 12
6
152 MM ϕ
6.0 DIA
10
16 (4)
23 (4)
30 (8)
36 (4)
109.0 (2769 MM)
60°
45°
86.25 (2191 MM)
85.0 (2159 MM)
(56) 19
(56) 26
(112) 33
(56) 39
(2) 9
48.5 (1232 MM)
61.0 (1549 MM)
2
38.0 (965 MM)
8
762 MM ϕ
30.0 DIA
19.5 (495 MM)
12.0 (305 MM)
6.0 (152 MM)
0
0
3
(12) 25
(12) 32
(12) 38
A
6706 ± 13 MM
264.0 ± .5
330 MM
13.0
152.4 MM
6.0
406 MM ϕ
16.00 DIA
305 MM ϕ
12.00 DIA
81.0 (2057 MM)
56.0 (1422 MM)
46.0 (1168 MM)
36.72 (933 MM)
25.0 (628 MM)
21.5 (546 MM)
12.0 (305 MM)
0
0
495 MM
19.5
19.5 (495 M)
11 3▷
17 (8)
24 (8)
31 (16)
37 (8)
1886 MM
74.25
7 REF
6 REF
4 REF
7°30'
VIEW B-B

AR	41		GRAFOIL	(UNION CARBIDE)
[illegible]	40		WASHER, LOCK 1½	CARBON STEEL
56	39		WASHER, LOCK 1¼	
60	38		WASHER, LOCK ⅞	
8	37		WASHER, LOCK ¾	
4	36		WASHER, LOCK ⅝	
	35			
[illegible]	34		WASHER, PLAIN 1½	
112	33		WASHER, PLAIN 1¼	
108	32		WASHER, PLAIN ⅞	
16	31		WASHER, PLAIN ¾	
8	30		WASHER, PLAIN ⅝	
	29			
	28			
[illegible]	27		NUT-HEX, 1½	
56	26		NUT-HEX, 1¼	
60	25		NUT-HEX, ⅞	
8	24		NUT-HEX, ¾	
4	23		NUT-HEX, ⅝	
	22			
	21			
[illegible]	20		BOLT-HEX HEAVY, 1½-6 UNC 2A 5½LG	
56	19		BOLT-HEX HEAVY, 1¼-7 UNC 2A 5½LG	
48	18		BOLT-HEX HD. ⅞-9 UNC 2A 5 LG	
8	17		BOLT-HEX HD. ¾-10 UNC 2A 4 LG	
4	16		BOLT-HEX HD. ⅝-11 UNC 2A 3¼LG	CARBON STEEL
48	15			
	14			
5	13		GASKET FLEXITALLIC CG LINE	40" 150 ANSI SS 304
4	12		GASKET FLEXITALLIC CG LINE	32" 150 ANSI SS 304
1	11		GASKET FLEXITALLIC CG LINE	8 150 ANSI SS 304
1	10		GASKET FLEXITALLIC CG LINE	3 150 ANSI SS 304
2	9		GASKET FLEXITALLIC CG LINE	30" 150 ANSI SS 304
1	8		BELLOWS	
1	7	C-24254	CYCLONE COLLECTOR	(DUCON-MIKROPUL LIMITED)
1	6	3100006	COMBUSTOR L VALVE SUB ASSY	
	5			
1	4	3100004	COMBUSTOR TOP SUB ASSY	
1	3	3100003	DISTRIBUTOR PLATE	
1	2	3100002	COMBUSTOR BOTTOM SUB ASSY	
/	1		ASSY	

LIST OF MATERIAL

FOR INFORMATION

CANMET
COMBUSTOR ASSY

GENERAL ATOMIC COMPANY

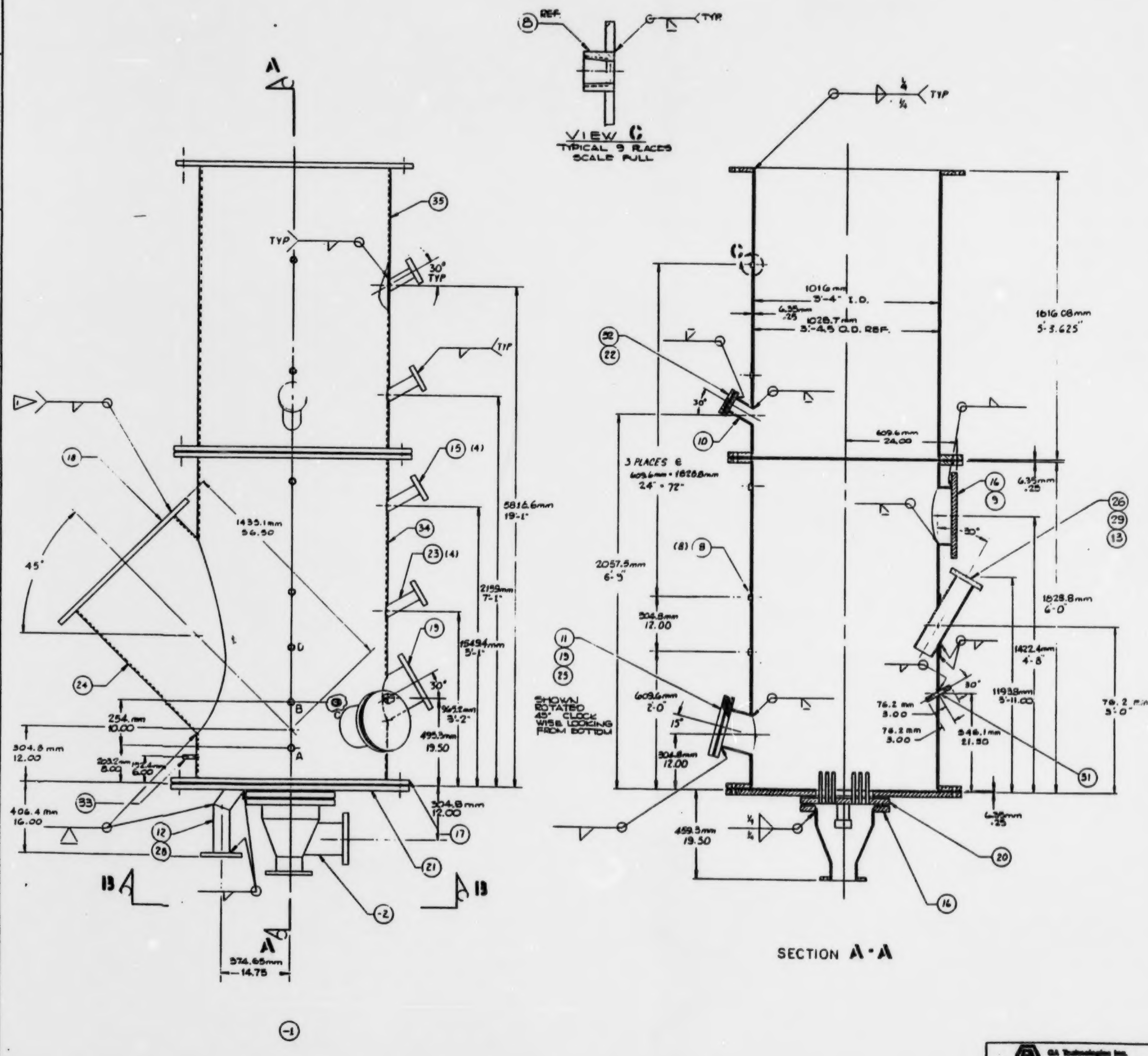
3100001

3100001

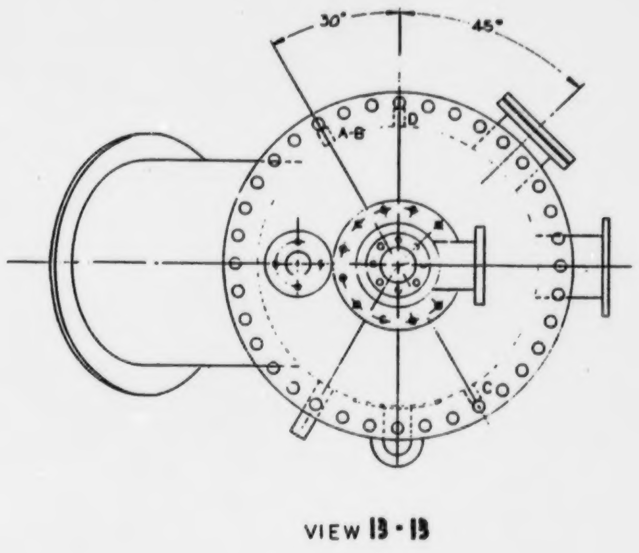
898

899

NOTES: UNLESS OTHERWISE SPECIFIED.
1. LEAVE FLANGE LOOSE TO MEET BELLOWS FLANGE BOLT HOLE CIRCLE.
2. SHAPE ITEM 23 CYLINDRICAL TO MEET WITH CYLINDER


B REF.
TYP
VIEW C
TYPICAL 9 PLACES
SCALE FULL
A
35
TYP
30° TYP
TYP
15 (4)
34
23 (4)
18
1435.1mm
56.50
5816.6mm
19-1"
2159mm
7-1"
1549.4mm
5'-1"
45°
19
30°
965.2mm
3'-2"
495.3mm
19.50
24
254.mm
10.00
B
A
304.8mm
12.00
203.2mm
8.00
152.4mm
6.00
406.4mm
16.00
33
12
28
21
17
304.8mm
12.00
-2
B
B
A
374.65mm
14.75
-1
1/4
1/4
TYP
C
1016mm
3'-4" I.D.
6.35mm
.25
1028.7mm
3'-4.5 O.D. REF.
1616.08mm
5'-3.625"
32
22
30°
10
3 PLACES @
609.6mm - 1828.8mm
24" - 72"
609.6mm
24.00
16
9
6.35mm
.25
26
29
13
30°
(8) 8
2057.5mm
6'-9"
304.8mm
12.00
1828.8mm
6'-0"
1422.4mm
4'-8"
11
19
25
SHOWN ROTATED 45° CLOCK WISE LOOKING FROM BOTTOM
609.6mm
2'-0"
15°
304.8mm
12.00
76.2mm
3.00
76.2mm
3.00
30°
1193.8mm
3'-11.00
546.1mm
21.50
76.2 min
3'-0"
31
459.3mm
19.50
1/4
1/4
6.35mm
.25
20
16
SECTION A-A

801


30°
45°
A-B
VIEW B-B

-2	-1	ITEM	PART NO.	DESCRIPTION	MATL
	1	35		UPPER SECT. .25 PLATE	C'STEEL
	1	34		LOWER SECT. .25 PLATE	C'STEEL
	1	33		PIPE ½ SCH. 40 x 5 LG	C'STEEL
	1	32		FLANGE-SLIP-ON ½ 150 LB STD	C'STEEL
	1	31		PIPE 1" SCH. 40 x 6" LG	C'STEEL
	12	30		STUD ⅝-3 UNC x 3 ¾ LG	
	1	29		PLATE	C'STEEL
	1	28		PIPE "3 SCH 40 X 7 LG	310 SS
	1	27		PIPE "3 SCH 40 X 10 LG	C'STEEL A-36
	1	26		PIPE "4 SCH 40 X 18 LG	C'STEEL A-36
	1	25		FLANGE BLIND "8" 150 LB STD	C'STEEL
	1	24		PIPE "30 SCH 40 X 37 LG	C'STEEL A-36
	4	23		SECONDARY AIR NOZZLE "2 SCH 40 LG 12 LG	C'STEEL A-36
	1	22		FLANGE BLIND "3 150 LB STD	C'STEEL
	1	21		FLANGE BLIND "40 125 LW	310 SS
	1	20	3100003	DISTRIBUTOR PLATE	
	1	19		FLANGE SLIP-ON "8 150 LB STD	C' STEEL
	1	18		FLANGE SLIP-ON "30 125 LW	
	1	17		FLANGE SLIP-ON "40 125 LW	
	1	16		FLANGE SLIP-ON "12 150 LB	
	4	15		FLANGE SLIP-ON "2 150 LB STD	
1		14		FLANGE SLIP-ON "6 150 LB STD	
	1	13		FLANGE SLIP-ON "4 150 LB STD	C' STEEL
	1	12		FLANGE SLIP-ON 3 150 LB STD	310 SS
	1	11		PIPE "8 SCH 40 X 3.00 LG	C'STEEL A-36
	1	10		PIPE "3 SCH 40 x 6" LG	
	1	9		PIPE "12 SCH 40 x 2½ LG	C'STEEL A-36
	9	8		HALF COUPLING	
1		7		CONCENTRIC 12 X 4 X 8 LG	C'STEEL A-36
1		6		PIPE "12 SCH 20 X 6 LG	
1		5		PIPE "4 SCH 40 X 4	
1		4		PIPE "6 SCH 40 X 7	C'STEEL A-36
		3			
		2	-2	ASSY	
		1	-1	ASSY	

LIST OF MATERIAL

GA Technologies Inc.
SAN DIEGO, CALIFORNIA

1 | FOR INFORMATION ONLY

SCALE 1/8

CANMET ARFBC PILOT PLANT

COMBUSTER BOTTOM
SUB ASSY

GENERAL ATOMIC COMPANY
SAN DIEGO, CALIFORNIA

800

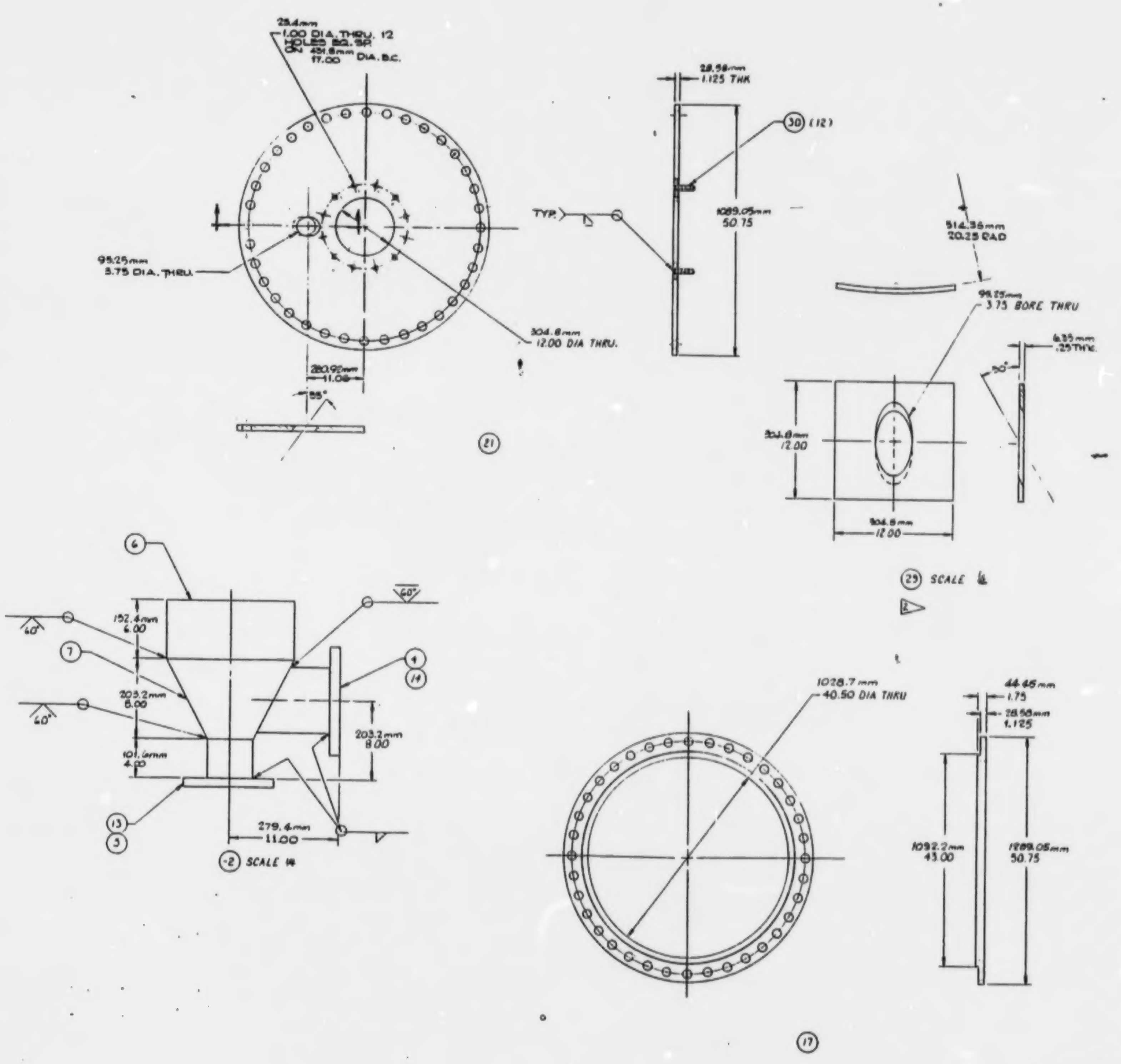
3100002 | A

SHT 1 OF 2

3100002

3100002
1 of 2

3100002 1
Sheet 2 of 2


25.4mm
1.00 DIA. THRU. 12 HOLES EQ. SP. ON 431.8mm 17.00 DIA. B.C.
95.25mm 3.75 DIA. THRU.
304.8mm 12.00 DIA THRU.
280.92mm 11.06
55°
TYP.
21
28.58mm 1.125 THK
30 (12)
1289.05mm 50.75
514.35mm 20.25 RAD
95.25mm 3.75 BORE THRU
6.35mm .25 THK.
30°
304.8mm 12.00
304.8mm 12.00
29 SCALE ¼
2
6
152.4mm 6.00
60°
7
203.2mm 8.00
60°
101.6mm 4.00
4
14
203.2mm 8.00
13
5
279.4mm 11.00
2 SCALE ¼
1028.7mm 40.50 DIA THRU
44.45mm 1.75
28.58mm 1.125
1092.2mm 43.00
1289.05mm 50.75
17

GA Technologies Inc.
SAN DIEGO, CALIFORNIA

LIST OF MATERIAL

CANMET ARFBC PILOT PLANT

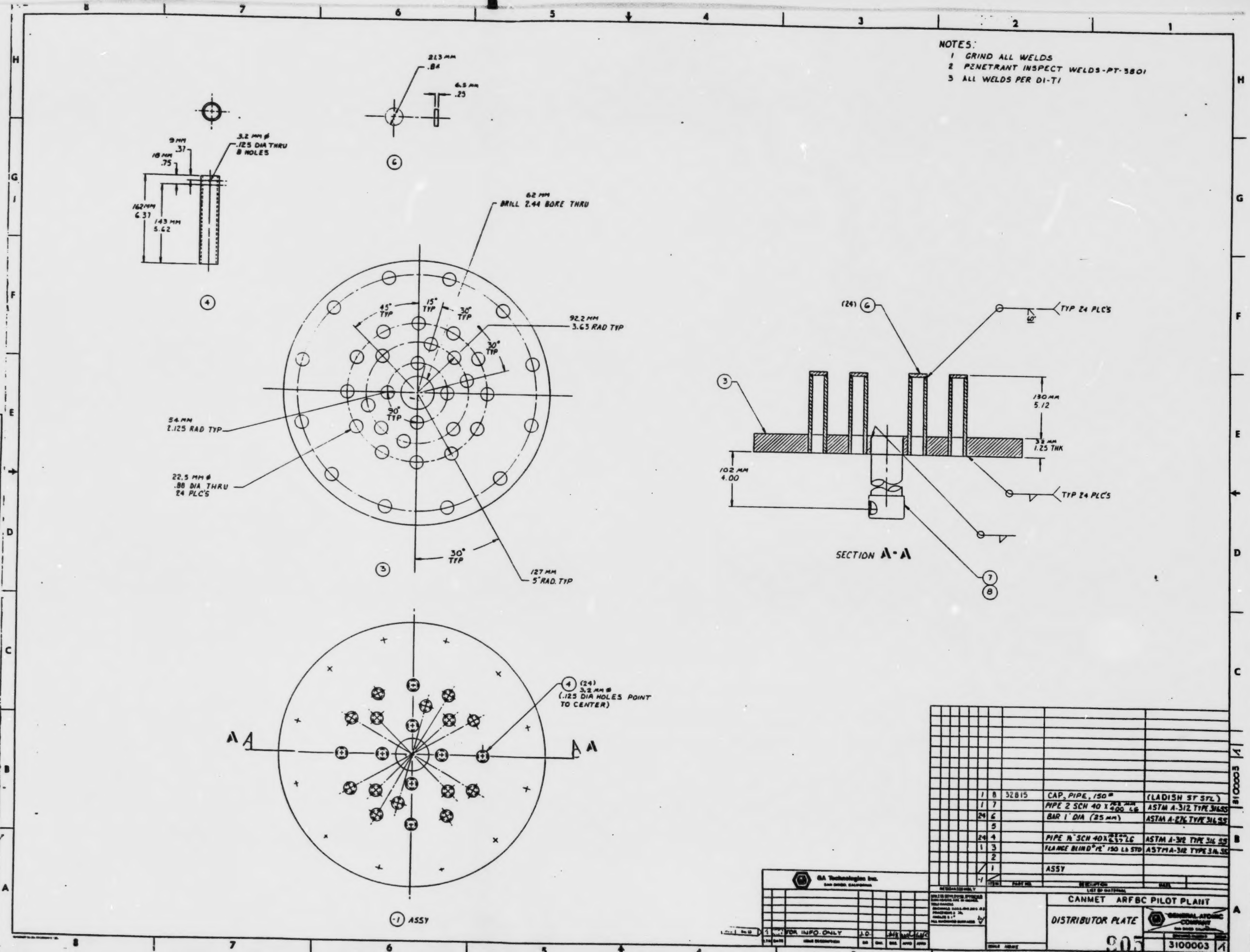
COMBUSTER BOTTOM
SUB ASSY

3100002 1

SHT 2 OF 2

902

903


8
7
6
5
4
3
2
1
H
G
F
E
D
C
B
A
9 MM
.37
18 MM
.75
3.2 MM ⌀
.125 DIA THRU
8 HOLES
162 MM
6.37
143 MM
5.62
④
21.3 MM
.84
6.5 MM
.25
⑥
62 MM
DRILL 2.44 BORE THRU
45° TYP
15° TYP
30° TYP
92.2 MM
3.63 RAD TYP
30° TYP
54 MM
2.125 RAD TYP
90° TYP
22.5 MM ⌀
.88 DIA THRU
24 PLC'S
30° TYP
127 MM
5" RAD. TYP
③
(24) ⑥
TYP 24 PLC'S
60°
③
130 MM
5.12
32 MM
1.25 THK
102 MM
4.00
TYP 24 PLC'S
SECTION A-A
⑦
⑧
A
A
A
A
④ (24)
3.2 MM ⌀
(.125 DIA HOLES POINT TO CENTER)
-1 ASSY
3100003

NOTES:
1 GRIND ALL WELDS
2 PENETRANT INSPECT WELDS-PT-3801
3 ALL WELDS PER DI-TI

LIST OF MATERIAL

		PART NO.	DESCRIPTION	MATL
1	8	32815	CAP, PIPE, 150#	(LADISH ST STL)
1	7		PIPE 2 SCH 40 X $\frac{102\ MM}{4.00}$ LG	ASTM A-312 TYPE 316SS
24	6		BAR 1" DIA (25 MM)	ASTM A-276 TYPE 316SS
	5			
24	4		PIPE ½" SCH 40 X $\frac{162\ MM}{6.37}$ LG	ASTM A-312 TYPE 316 SS
1	3		FLANGE BLIND 12" 150 Lb STD	ASTM A-312 TYPE 316 SS
	2			
	1		ASSY	
-1				

GA Technologies Inc.
SAN DIEGO, CALIFORNIA

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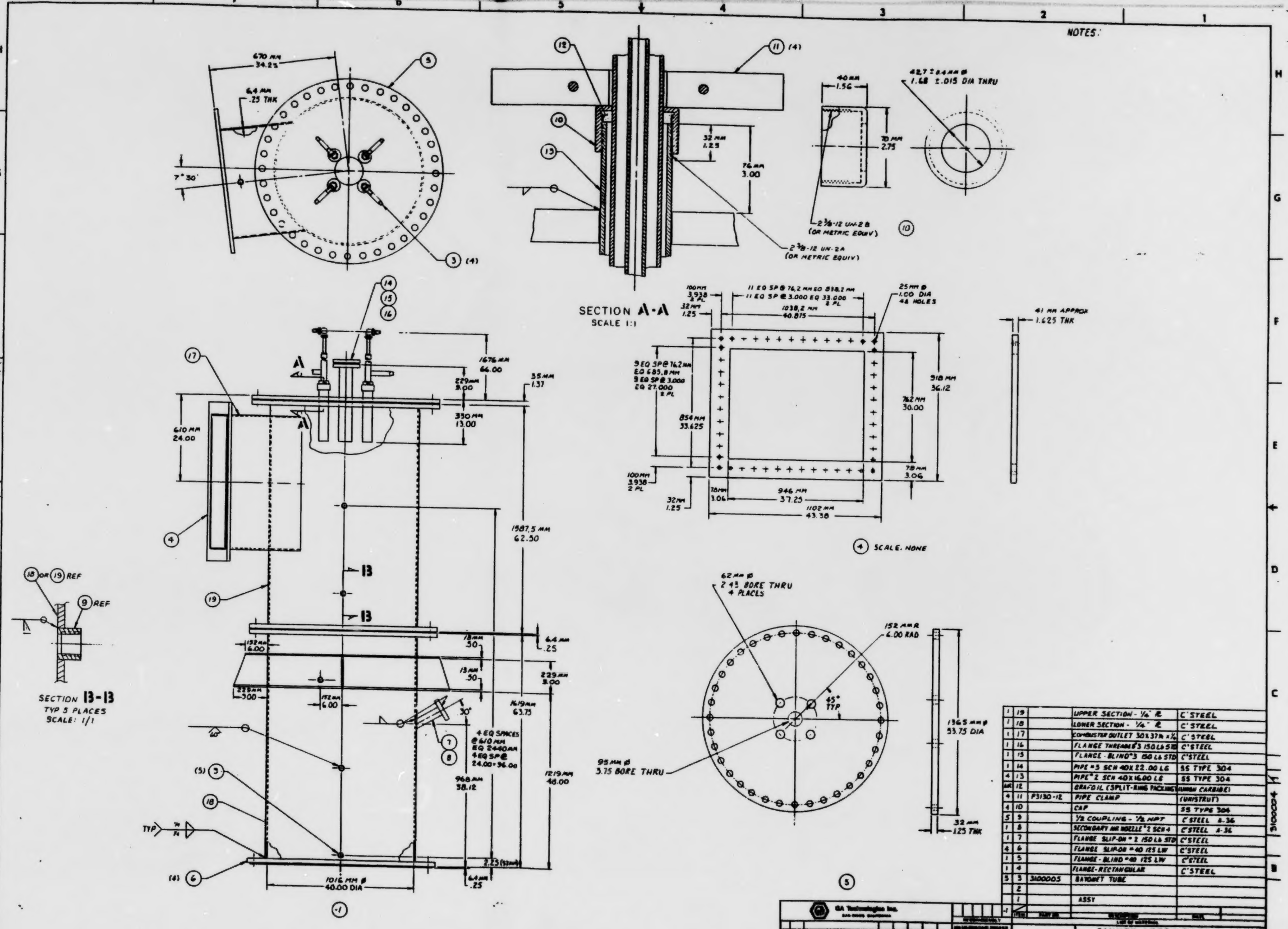
CANMET ARFBC PILOT PLANT

DISTRIBUTOR PLATE

GENERAL ATOMIC COMPANY

3100003 A

905


NOTES:
670 MM
34.25
6.4 MM
.25 THK
7° 30'
5
3 (4)
12
11 (4)
10
13
32 MM
1.25
76 MM
3.00
2 3/8-12 UN-2A
(OR METRIC EQUIV)
40 MM
1.56
70 MM
2.75
2 3/8-12 UN-2B
(OR METRIC EQUIV)
10
42.7 ±.04 MM ø
1.68 ±.015 DIA THRU
SECTION A-A
SCALE 1:1
14
15
16
17
A
A
1676 MM
66.00
229 MM
9.00
35 MM
1.37
350 MM
13.00
610 MM
24.00
1587.5 MM
62.50
4
B
B
19
18 OR 19 REF
9 REF
SECTION B-B
TYP 5 PLACES
SCALE: 1/1
13 MM
.50
6.4 MM
.25
152 MM
6.00
13 MM
.50
229 MM
9.00
229 MM
9.00
152 MM
6.00
1619 MM
63.75
30°
7
8
4 EQ SPACES
@ 610 MM
EQ 2440 MM
4 EQ SP @
24.00 = 96.00
968 MM
38.12
1219 MM
48.00
60°
(5) 5
18
TYP 1/4
2.25 (57 MM)
6.4 MM
.25
(4) 6
1016 MM ø
40.00 DIA
-1
100 MM
3.938
2 PL
32 MM
1.25
11 EQ SP @ 76.2 MM EQ 838.2 MM
11 EQ SP @ 3.000 EQ 33.000
2 PL
1038.2 MM
40.875
25 MM ø
1.00 DIA
48 HOLES
9 EQ SP @ 76.2 MM
EQ 685.8 MM
9 EQ SP @ 3.000
EQ 27.000
2 PL
854 MM
33.625
762 MM
30.00
918 MM
36.12
78 MM
3.06
100 MM
3.938
2 PL
32 MM
1.25
78 MM
3.06
946 MM
37.25
1102 MM
43.38
4 SCALE: NONE
41 MM APPROX
1.625 THK
62 MM ø
2.43 BORE THRU
4 PLACES
152 MM R
6.00 RAD
45° TYP
95 MM ø
3.75 BORE THRU
1365 MM ø
53.75 DIA
32 MM
1.25 THK
5
H
G
F
E
D
C
B
A
8
7
6
5
4
3
2
1

1	19		UPPER SECTION - 1/4" R	C'STEEL
1	18		LOWER SECTION - 1/4" R	C'STEEL
1	17		COMBUSTER OUTLET 30X37 1/2 x 1/4	C'STEEL
1	16		FLANGE THREADED 3 150 LB STD	C'STEEL
1	15		FLANGE - BLIND 3 150 LB STD	C'STEEL
1	14		PIPE 3 SCH 40X 22.00 LG	SS TYPE 304
4	13		PIPE 2 SCH 40X16.00 LG	SS TYPE 304
AR	12		GRAFOIL (SPLIT-RING PACKING)	(UNION CARBIDE)
4	11	P3130-12	PIPE CLAMP	(UNISTRUT)
4	10		CAP	SS TYPE 304
5	9		1/2 COUPLING - 1/2 NPT	C'STEEL A-36
1	8		SECONDARY AIR NOZZLE 2 SCH 4	C'STEEL A-36
1	7		FLANGE SLIP-ON 2 150 LB STD	C'STEEL
4	6		FLANGE SLIP-ON 40 125 LW	C'STEEL
1	5		FLANGE - BLIND 40 125 LW	C'STEEL
1	4		FLANGE-RECTANGULAR	C'STEEL
5	3	3100005	BAYONET TUBE	
	2			
	1		ASSY	
-1				

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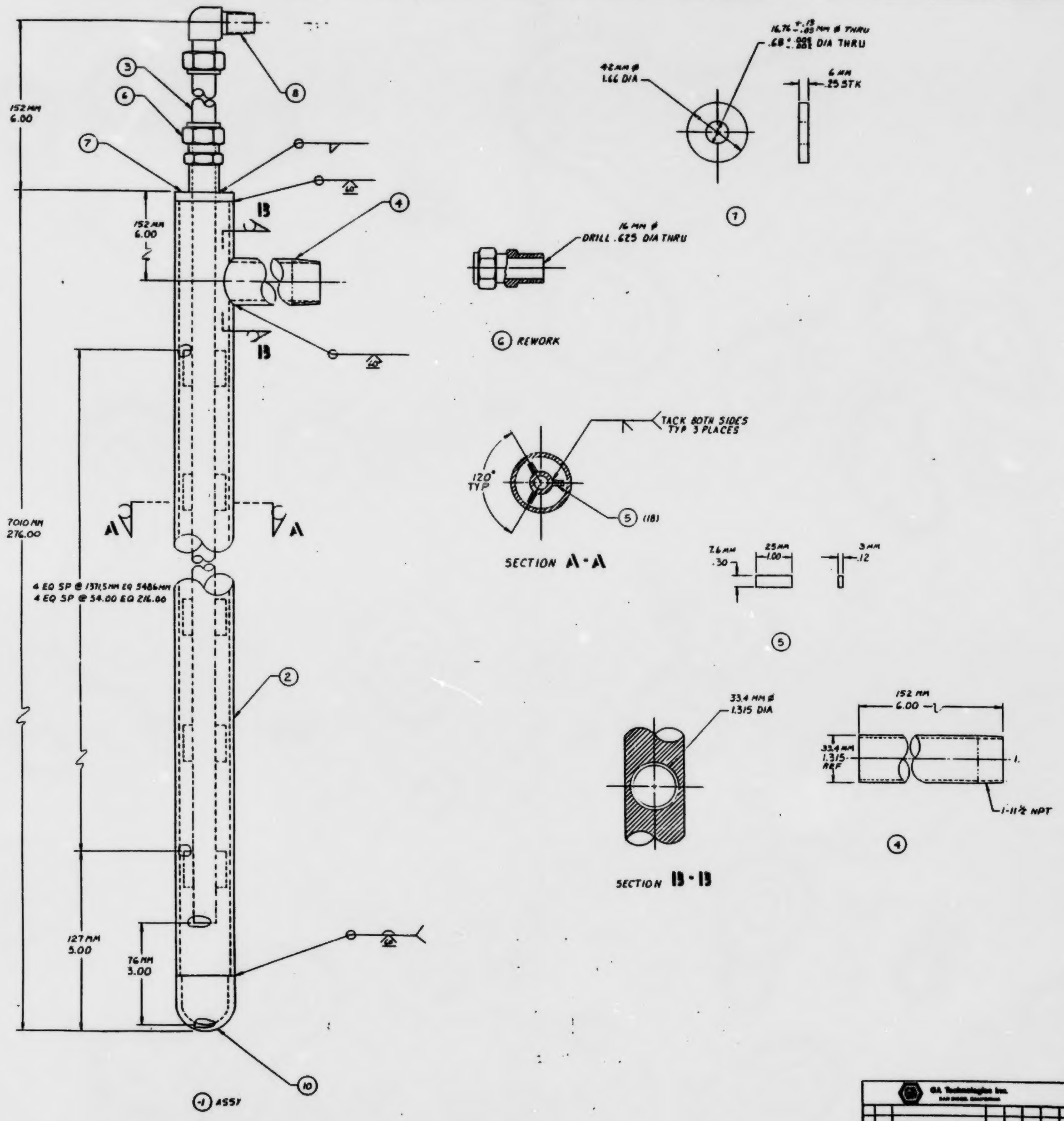
CANMET ARFBC PILOT PLANT

COMBUSTOR TOP
SUB ASSY

3100004 1


③
⑥
⑦
⑧
④
②
⑩
152 MM
6.00
152 MM
6.00
7010 MM
276.00
4 EQ SP @ 1371.5 MM EQ 5486 MM
4 EQ SP @ 54.00 EQ 216.00
127 MM
5.00
76 MM
3.00
B
B
A
A
⊖1 ASSY
16 MM ⌀
DRILL .625 DIA THRU
⑥ REWORK
16.76 +.13 −.05 MM ⌀ THRU
.68 +.005 −.002 DIA THRU
42 MM ⌀
1.66 DIA
6 MM
.25 STK
⑦
TACK BOTH SIDES
TYP 3 PLACES
120° TYP
⑤ (18)
SECTION A-A
7.6 MM
.30
25 MM
1.00
3 MM
.12
⑤
33.4 MM ⌀
1.315 DIA
SECTION B-B
152 MM
6.00
33.4 MM
1.315
REF
1-11½ NPT
④

NOTES:
1 GRIND ALL WELDS
2 PENETRANT INSPECT WELDS-PT-3801
3 ALL WELDS PER DI-TI

	19			
	18			
	17			
	16			
	15			
	14			
	13			
	12			
	11			
1	10	49	CAP 1¼" SHC 80	(LADISH)
	9			
1	8	SS1010-2-8	UNION ELBOW	316 SS (SWAGELOK)
1	7		CAP 1.66 DIA X ¼ THK	ASTM-312 TYPE 304SS
1	6	1010-1-8MPW	PIPE WELD CONNECTOR	316 SS (SWAGELOCK)
18	5		SPACER	ASTM-312 TYPE 304SS
1	4		PIPE 1" SCH 40 X 6"	ASTM-312 TYPE 304SS
1	3		TUBING ⅝ O.D BWG 18 X 23'	ASTM-312 TYPE 304SS
1	2		PIPE, 1¼ SCH. 40 X 23'	ASTM A-312 TYPE 304SS
/	1		ASSY	
-1				

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CANMET ARFBC PILOT PLANT

BAYONET TUBE

909

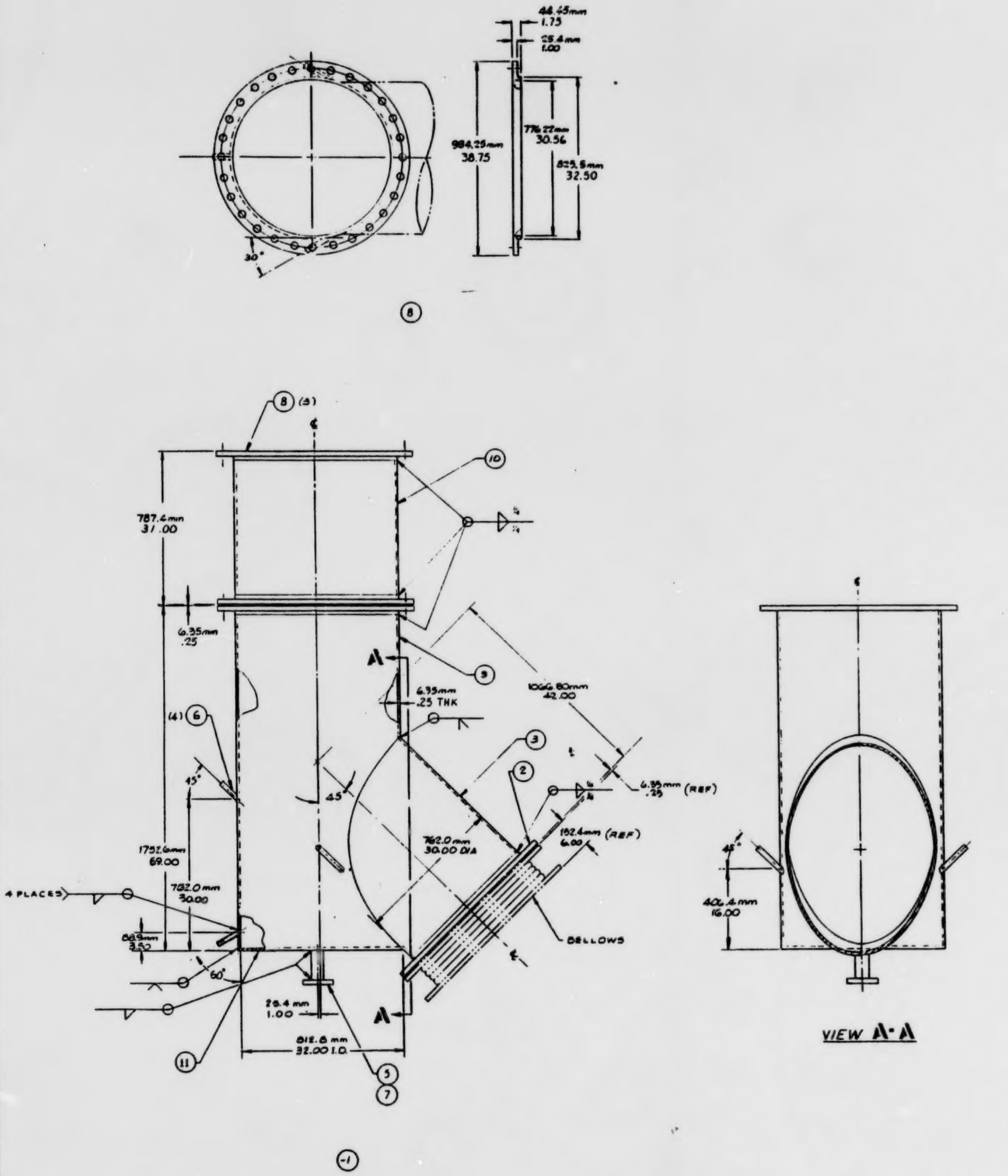
GENERAL ATOMIC COMPANY

SCALE FULL

3100005 | 1

WAS 5244162

3100005


44.45mm
1.75
25.4mm
1.00
984.25mm
38.75
776.22mm
30.56
825.5mm
32.50
30°
8
8 (3)
10
787.4mm
31.00
6.35mm
.25
A
9
6.35mm
.25 THK
1066.80mm
42.00
(4) 6
3
2
6.35mm (REF)
.25
45°
45
1752.6mm
69.00
762.0mm
30.00 DIA
152.4mm (REF)
6.00
4 PLACES
762.0mm
30.00
88.9mm
3.50
BELLOWS
60°
25.4mm
1.00
812.8mm
32.00 I.D.
A
11
5
7
-1
406.4mm
16.00
45°
VIEW A-A

1	11		PLATE ¼"	C'STEEL
1	10		CYLINDER	C'STEEL
1	9		CYLINDER	
3	8		FLANGE 32" SLIP-ON 125 LW	
1	7		FLANGE 2" SLIP-ON 150 LB STD	
4	6		PIPE 1" SCH 40 X 6.00 LG	
1	5		PIPE 2" SCH 40 X 6.00 LG	C'STEEL
3	4		PIPE ½" SCH 40	C'STEEL A-36
1	3		CYLINDER	C'STEEL
1	2		FLANGE 30" SLIP ON 125 LW	C'STEEL
	1		ASSY	
-1				

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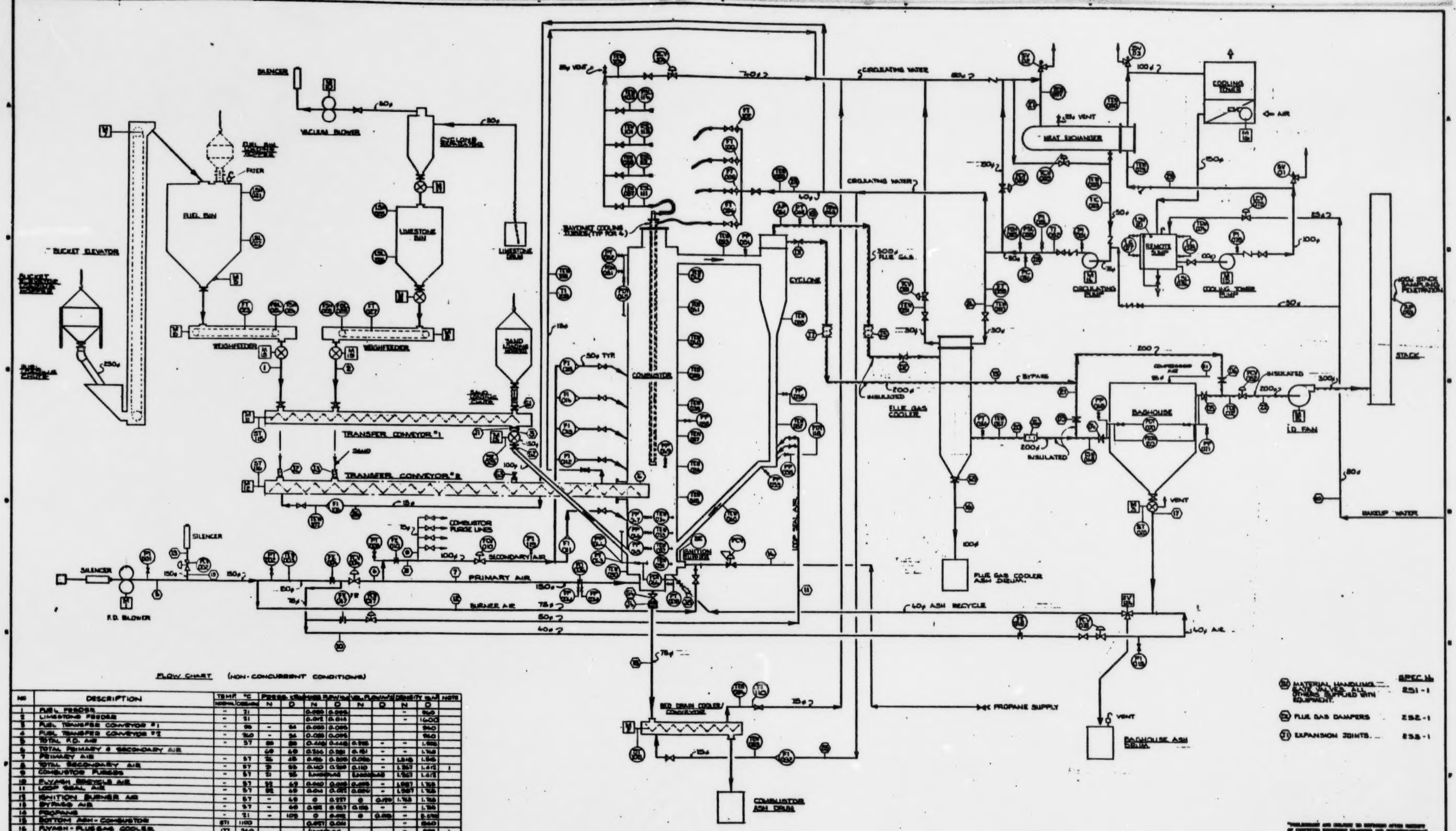
CANMET ARFBC PILOT PLANT

COMBUSTOR
L VALVE
SUB ASSY

GENERAL ATOMIC COMPANY

3100006

MECHANICAL


SILENCER
VACUUM BLOWER
50⌀
CYCLONE SEPARATOR
FUEL BIN
FILTER
LIMESTONE BIN
LIMESTONE DRUM
BUCKET ELEVATOR
250⌀
WEIGHFEEDER
WEIGHFEEDER
SAND
TRANSFER CONVEYOR #1
TRANSFER CONVEYOR #2
COMBUSTOR PURGE LINES
SECONDARY AIR
PRIMARY AIR
BURNER AIR
SILENCER
F.D. BLOWER
150⌀
50⌀ TYP.
BAYONET COOLING TUBES (TYP FOR 4)
COMBUSTOR
CYCLONE
IGNITION BURNER
LOOP SEAL AIR
CIRCULATING WATER
HEAT EXCHANGER
COOLING TOWER
AIR
CIRCULATING PUMP
REMOTE SUMP
COOLING TOWER PUMP
300⌀ FLUE GAS
INSULATED
FLUE GAS COOLER
BYPASS
BAGHOUSE
COMPRESSED AIR
I.D. FAN
STACK
STACK SAMPLING POSITION
MAKEUP WATER
VENT
FLUE GAS COOLER ASH DRUM
40⌀ ASH RECYCLE
40⌀ AIR
PROPANE SUPPLY
BED DRAIN COOLER/CONVEYOR
COMBUSTOR ASH DRUM
BAGHOUSE ASH DRUM

FLOW CHART (NON-CONCURRENT CONDITIONS)

NO	DESCRIPTION	TEMP. °C		PRESS. kPa		MASS FLOW kg/s		VOL. FLOW m³/s		DENSITY kg/m³		NOTE
		NORMAL	DESIGN	N	D	N	D	N	D	N	D	
1	FUEL FEEDER	-	21			0.085	0.095			-	960	
2	LIMESTONE FEEDER	-	21			0.012	0.014			-	1600	
3	FUEL TRANSFER CONVEYOR #1	-	95	-	34	0.085	0.095				960	
4	FUEL TRANSFER CONVEYOR #2	-	260	-	34	0.085	0.095				960	
5	TOTAL F.D. AIR	-	57	80	80	0.448	0.448	[illegible]	-	-	[illegible]	
6	TOTAL PRIMARY & SECONDARY AIR			69	69	0.266	0.281	0.151	-	-	1.765	
7	PRIMARY AIR	-	57	26	45	0.156	0.205	[illegible]	-	1.816	1.545	
8	TOTAL SECONDARY AIR	-	57	31	55	0.110	[illegible]	0.110	-	1.257	1.412	1
9	COMBUSTOR PURGES	-	57	31	55	(UNKNOWN)		(UNKNOWN)		1.257	1.412	
10	FLYASH RECYCLE AIR	-	57	92	69	0.040	[illegible]	[illegible]	-	1.987	1.765	
11	LOOP SEAL AIR	-	57	92	69	0.014	[illegible]	[illegible]	-	1.987	1.765	
12	IGNITION BURNER AIR	-	57	-	69	0	0.227	0	[illegible]	1.765	1.765	
13	BYPASS AIR	-	57	-	60	[illegible]	0.057	[illegible]	-	-	1.7[illegible]	
14	PROPANE	-	21	-	103	0	[illegible]	0	([illegible])	-	[illegible]	
15	BOTTOM ASH - COMBUSTOR	871	1100			[illegible]	[illegible]			-	1040	
16	FLYASH - FLUEGAS COOLER	177	260			(UNKNOWN)				-	[illegible]	1
17	FLYASH - BAGHOUSE	177	260			[illegible]	[illegible]			-	[illegible]	
18	FLUEGAS - HOT & DIRTY	[illegible]	1100	0	0	[illegible]	[illegible]	[illegible]	1.075	[illegible]	[illegible]	
19	FLUEGAS - COOLER BYPASS	100	177	0	0	0	0.811	0	[illegible]	-	[illegible]	
20	FLUEGAS - COOL & DIRTY	177	260	-1	-2	0.311	[illegible]	[illegible]	0.740	0.819	[illegible]	
21	FLUEGAS - BAGHOUSE BYPASS	177	260	-1	-2	0	0.811	0	[illegible]	0.819	[illegible]	
22	FLUEGAS - COOL & CLEAN	177	260	-4	-5	[illegible]	[illegible]	[illegible]	[illegible]	0.819	[illegible]	
23	COOLING WATER - BAYONET TUBES	-	29	-	570	-	[illegible]	-	[illegible]	-	996	2
24	COOLING WATER - FLUEGAS COOLER	-	29	-	470	-	2.[illegible]	-	[illegible]	-	996	2
25	COOLING WATER - BED DRAIN COOLER	-	29	-	980	-	[illegible]	-	30	-	996	2
26	COOLING WATER - FUEL CONVEYOR #2	-	29	-	560	-	0.577	-	35	-	996	2
27	COOLING WATER RETURN	-	46	-	103	-	6.016	-	[illegible]	-	990	2
28	COOLING WATER SUPPLY	-	29	-	612	-	6.016	-	417	-	996	2
29	COOLING TOWER WATER	-	24	-	17[illegible]	-	20.10[illegible]	-	1,200	-	997	2
30	MAKEUP WATER	-	16	-	210	-	1.0	-	60	-	998	2
31	COMPRESSED AIR	-	21	-	689	-	[illegible]	-	[illegible]	-	[illegible]	

NOTES:
1. VALUE UNCERTAIN AT THIS TIME.
2. WATER VOLUME FLOWS IN ℓ/m.

SPEC No.	
(51) MATERIAL HANDLING — GATE VALVES. ALL OTHERS SUPPLIED WITH EQUIPMENT.	251-1
(52) FLUE GAS DAMPERS	252-1
(53) EXPANSION JOINTS.	253-1

[illegible]

LB	DS			[illegible]	MILESTONE ISSUE	[illegible]	O	
LB					FINAL REPORT ISSUE	[illegible]	A	COOLING & CIRCULATION WATER SYSTEM REVISED

ENERGY, MINES & RESOURCES
CANADA

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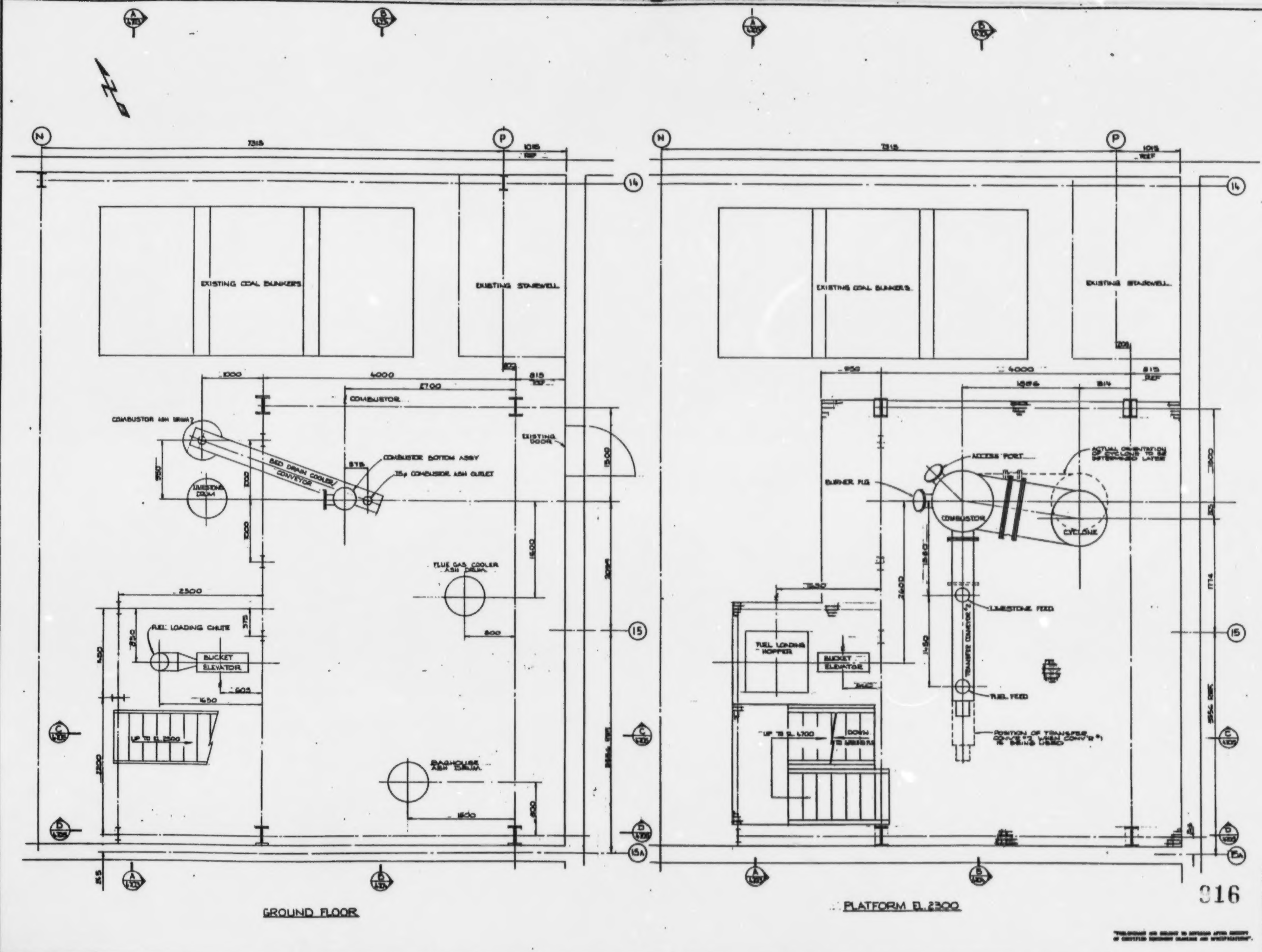
ARFBC: RESEARCH FACILITY
P & I DIAGRAM

A0 0243 1 - 4601 A


N
P
7315
1015
REF
14
15
15A
EXISTING COAL BUNKERS
EXISTING STAIRWELL
1000
4000
2700
815
REF
COMBUSTOR
COMBUSTOR ASH DRUM
LIMESTONE DRUM
BED DRAIN COOLER/CONVEYOR
COMBUSTOR BOTTOM ASSY
15φ COMBUSTOR ASH OUTLET
EXISTING DOOR
FLUE GAS COOLER ASH DRUM
FUEL LOADING CHUTE
BUCKET ELEVATOR
UP TO EL 2300
BAGHOUSE ASH DRUM
2500
1650
605
800
1600
1500
950
1886
814
ACCESS PORT
BURNER FLG
ACTUAL ORIENTATION OF CYCLONE TO BE DETERMINED LATER
CYCLONE
LIMESTONE FEED
FUEL FEED
TRANSFER CONVEYOR #2
POSITION OF TRANSFER CONV'R #2 WHEN CONV'R #1 IS BEING USED
FUEL LOADING HOPPER
UP TO EL 4700
DOWN TO GROUND FLR
2600
1450
1774
A
B
C
D

GROUND FLOOR

PLATFORM EL 2300

LB	REVIEW	[illegible]	O	
LB	REVIEW	[illegible]	A	GENERAL REVISION
LB	MILESTONE ISSUE	[illegible]	B	
LB	FINAL REPORT ISSUE	[illegible]	C	GENERAL REVISION

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CANADA

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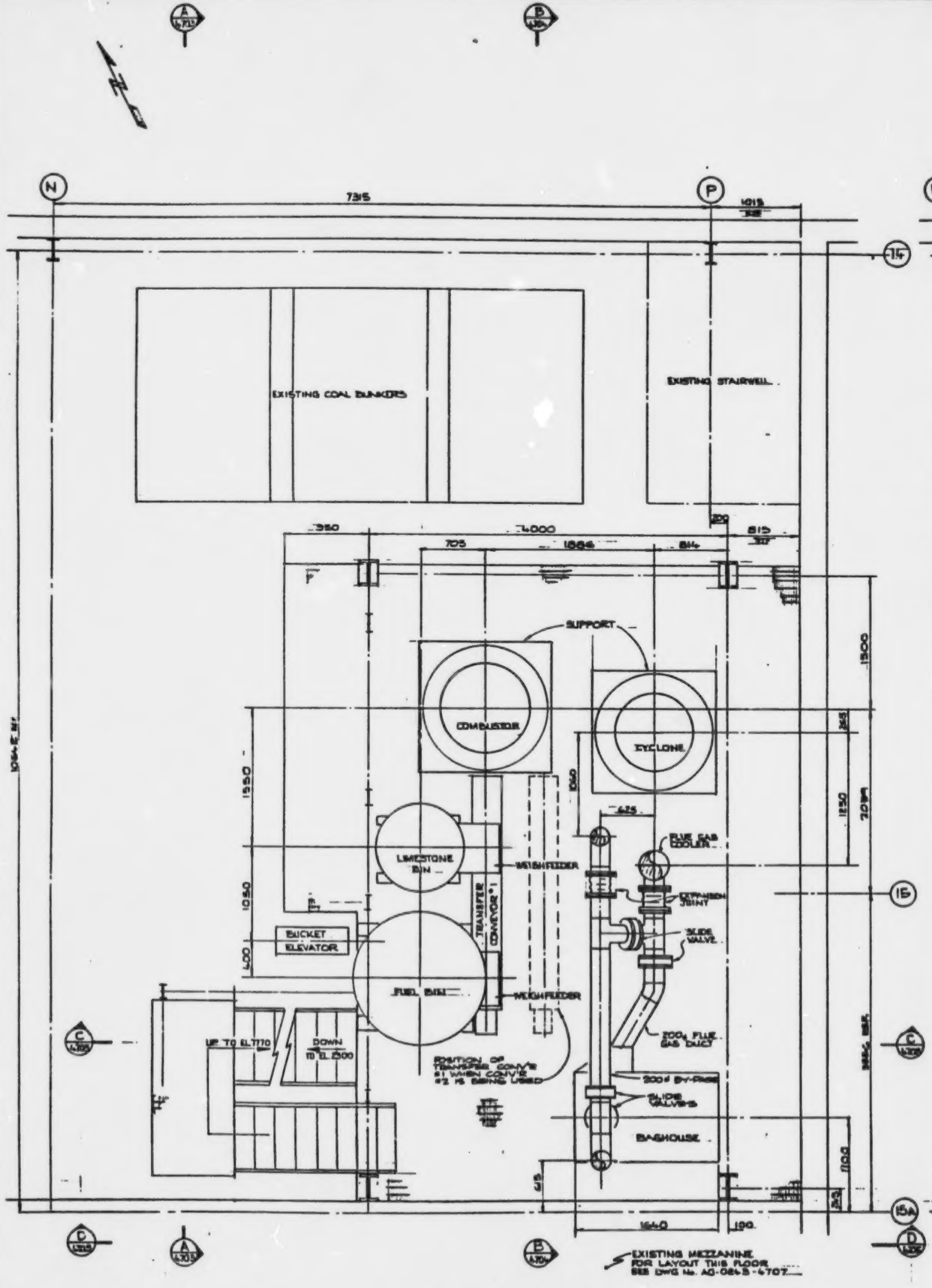
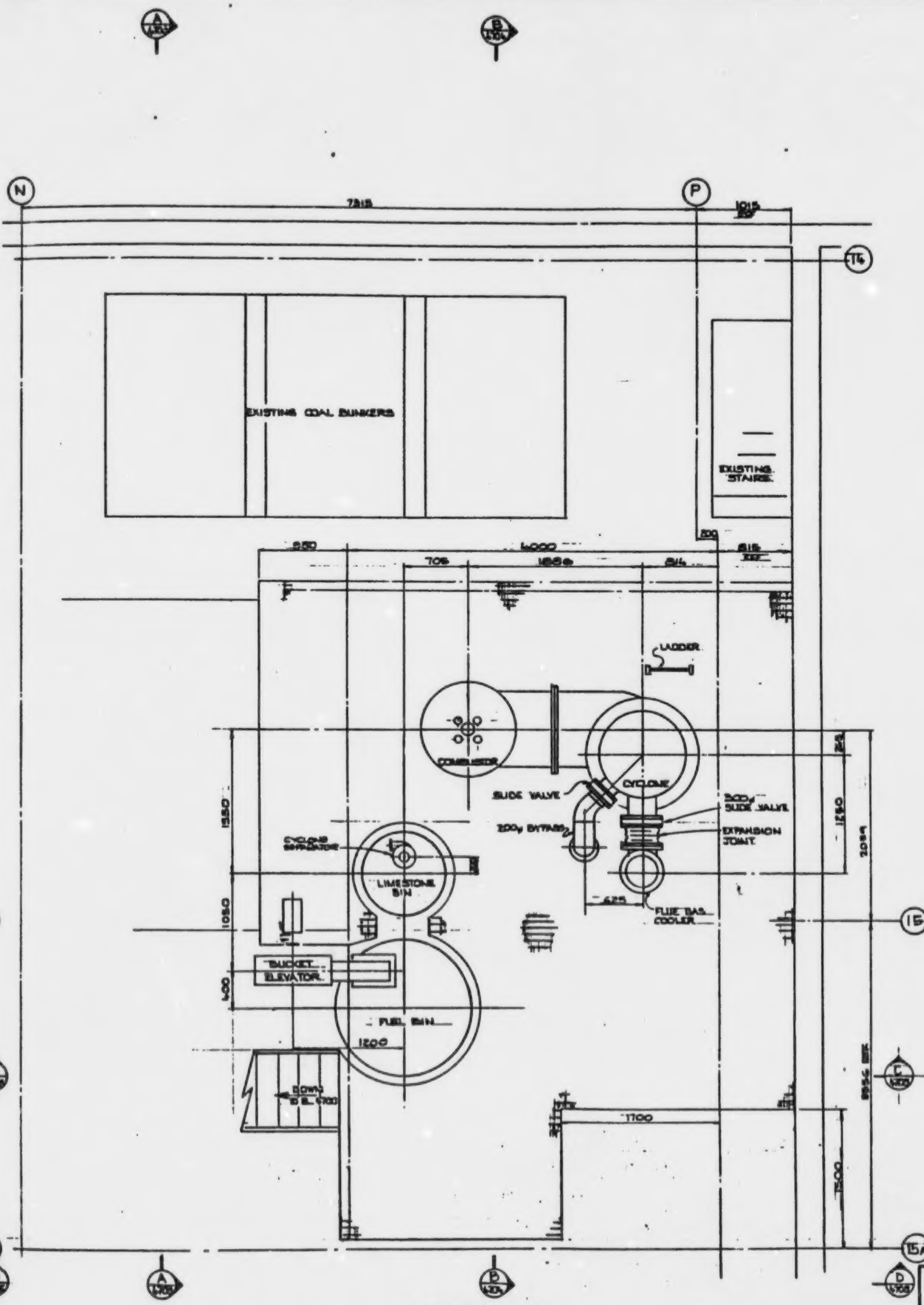
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
GROUND FLOOR & PLATFORM EL 2300

AO 0243 4701 C


A
B
N
P
7315
1015
T6
EXISTING COAL BUNKERS
EXISTING STAIRWELL
350
4000
705
1886
814
200
815
SUPPORT
COMBUSTOR
CYCLONE
1500
1550
1050
1400
1040
625
1250
2084
LIMESTONE BIN
WEIGHFEEDER
TRANSFER CONVEYOR #1
FLUE GAS COOLER
EXPANSION JOINT
SLIDE VALVE
BUCKET ELEVATOR
FUEL BIN
WEIGHFEEDER
UP TO EL 7770
DOWN TO EL 2500
POSITION OF TRANSFER CONV'R #1 WHEN CONV'R #2 IS BEING USED
200φ FLUE GAS DUCT
200φ BY-PASS
SLIDE VALVES
BAGHOUSE
15
15A
C
D
1100
1640
190
615
EXISTING MEZZANINE FOR LAYOUT THIS FLOOR SEE DWG No. A0-0243-4707

817

PLATFORM EL 4700


A
B
N
P
7315
1015
T6
EXISTING COAL BUNKERS
EXISTING STAIRS
350
4000
705
1886
814
200
815
LADDER
COMBUSTOR
CYCLONE
SLIDE VALVE
300φ SLIDE VALVE
200φ BYPASS
EXPANSION JOINT
CYCLONE SEPARATOR
LIMESTONE BIN
625
FLUE GAS COOLER
1550
1050
1400
1250
2084
BUCKET ELEVATOR
FUEL BIN
1200
DOWN TO EL 4700
1700
1100
15
15A
C
D

PLATFORM EL 7770

818

LR						REVIEW		O	
LR						REVIEW		A	GENERAL REVISION
LR						MILESTONE ISSUE		B	
LR						FINAL REPORT ISSUE		C	GENERAL REVISION.

Scale 1:50

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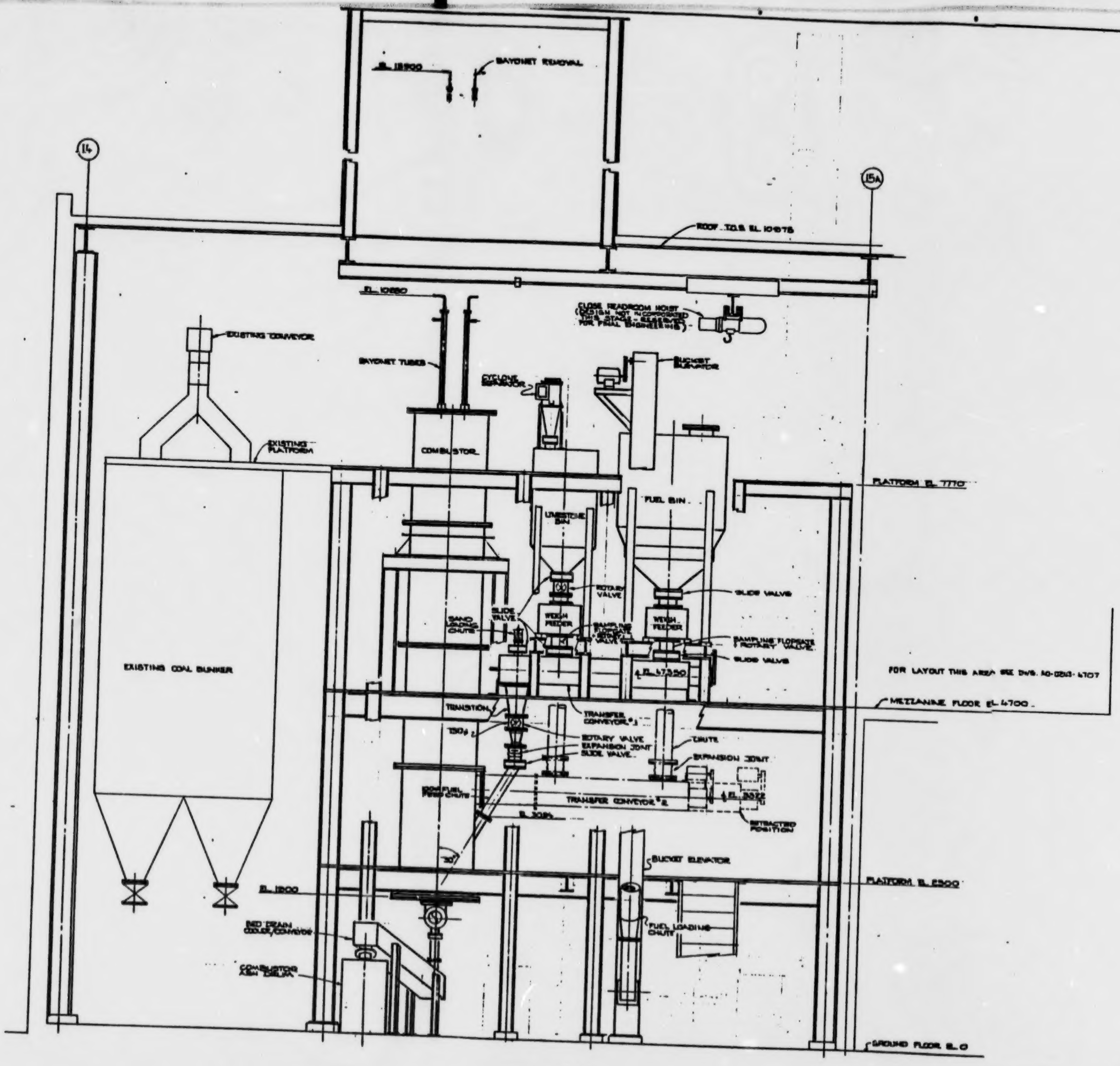
GENERAL ARRANGEMENT
PLATFORM EL 4700 & 7770

A0 0243 4702 C


EL 15900
BAYONET REMOVAL
14
15A
ROOF T.O.S. EL 10075
EL 10850
CLOSE HEADROOM HOIST (DESIGN NOT INCORPORATED THIS STAGE - RESERVED FOR FINAL ENGINEERING)
EXISTING CONVEYOR
BAYONET TUBES
CYCLONE SEPARATOR
BUCKET ELEVATOR
EXISTING PLATFORM
COMBUSTOR
PLATFORM EL 7770
LIMESTONE BIN
FUEL BIN
ROTARY VALVE
SLIDE VALVE
SLIDE VALVE
SAND LOADING CHUTE
WEIGH FEEDER
SAMPLING FLOPGATE + ROTARY VALVE
WEIGH FEEDER
SAMPLING FLOPGATE + ROTARY VALVE
SLIDE VALVE
EL 5735O
EXISTING COAL BUNKER
FOR LAYOUT THIS AREA SEE DWG. AD-0243-4707
MEZZANINE FLOOR EL 4700
TRANSITION
TRANSFER CONVEYOR #1
150φ
ROTARY VALVE
EXPANSION JOINT
SLIDE VALVE
CHUTE
EXPANSION JOINT
100φ FUEL FEED CHUTE
TRANSFER CONVEYOR #2
EL 3022
EL 3034
RETRACTED POSITION
30°
BUCKET ELEVATOR
PLATFORM EL 2300
EL 1900
BED DRAIN COOLER/CONVEYOR
FUEL LOADING CHUTE
COMBUSTOR ASH DRUM
GROUND FLOOR EL 0

SECTION A/A

PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS.

						Issued For	Date	Rev	Description of Revision
LE	-					REVIEW		O	
LE						REVIEW		A	GENERAL REVISION.
LE		DW				MILESTONE ISSUE		B	
LE						FINAL REPORT ISSUE		C	GENERAL REVISION.

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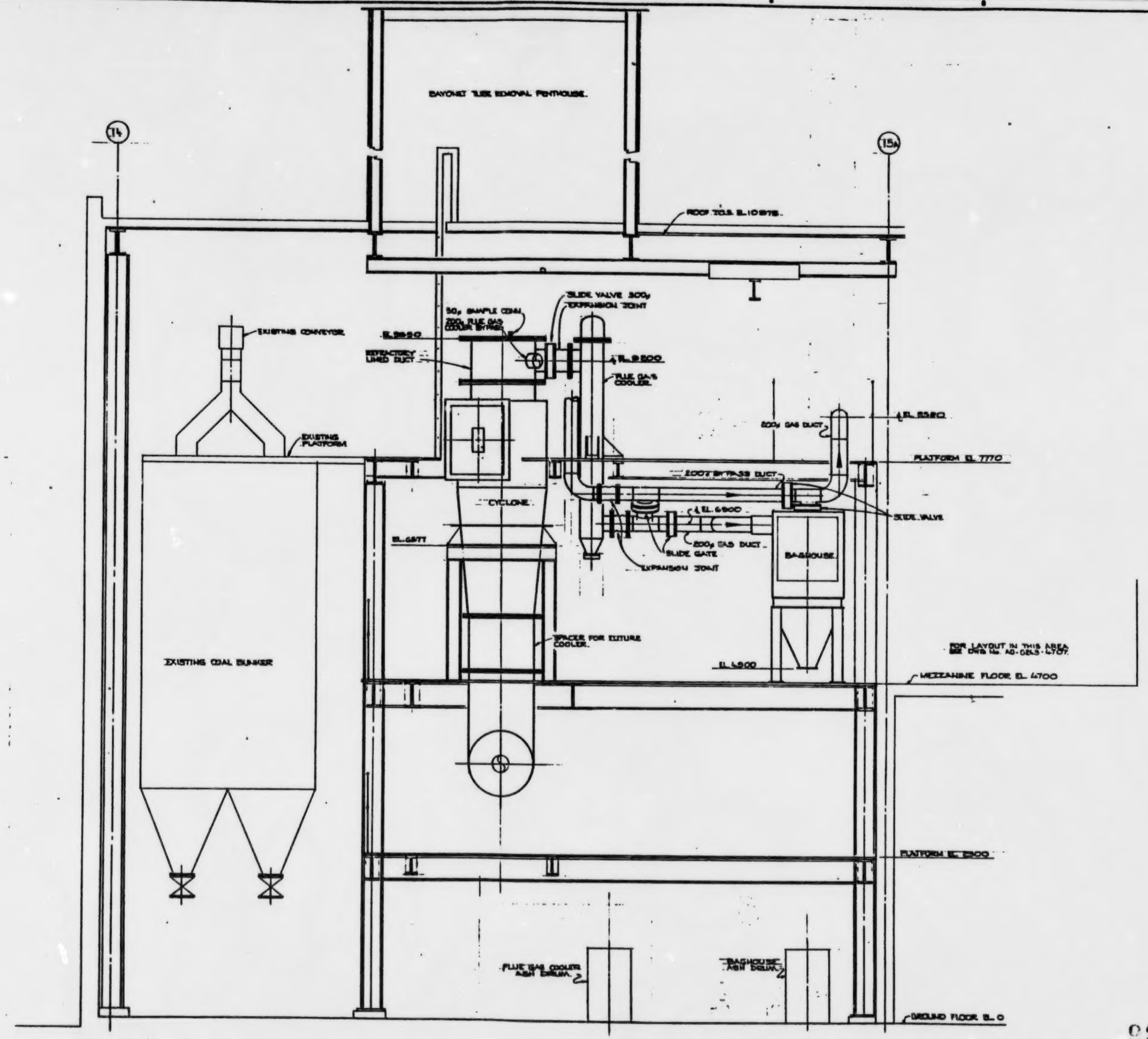
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
SECTION A

AD 0243


BAYONET TUBE REMOVAL PENTHOUSE.
14
15A
ROOF T.O.S. EL. 10975
EXISTING CONVEYOR
EXISTING PLATFORM
50φ SAMPLE CONN.
200φ FLUE GAS COOLER BYPASS
EL. 9950
REFRACTORY LINED DUCT
SLIDE VALVE 300φ
EXPANSION JOINT
EL. 9200
FLUE GAS COOLER
200φ GAS DUCT
EL. 8320
PLATFORM EL. 7770
200φ BYPASS DUCT
SLIDE VALVE
CYCLONE
EL. 6900
200φ GAS DUCT
SLIDE GATE
EXPANSION JOINT
BAGHOUSE
EL. 6577
SPACER FOR FUTURE COOLER.
FOR LAYOUT IN THIS AREA SEE DWG No. A0-0243-4707.
EL. 4900
MEZZANINE FLOOR EL. 4700
EXISTING COAL BUNKER
PLATFORM EL. 2500
FLUE GAS COOLER ASH DRUM.
BAGHOUSE ASH DRUM.
GROUND FLOOR EL. 0

SECTION B B

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

L.B.		REVIEW		0	
L.B.		REVIEW		A	GENERAL REVISION
L.B.		MILESTONE ISSUE		B	
L.B.		FINAL REPORT ISSUE		C	GENERAL REVISION

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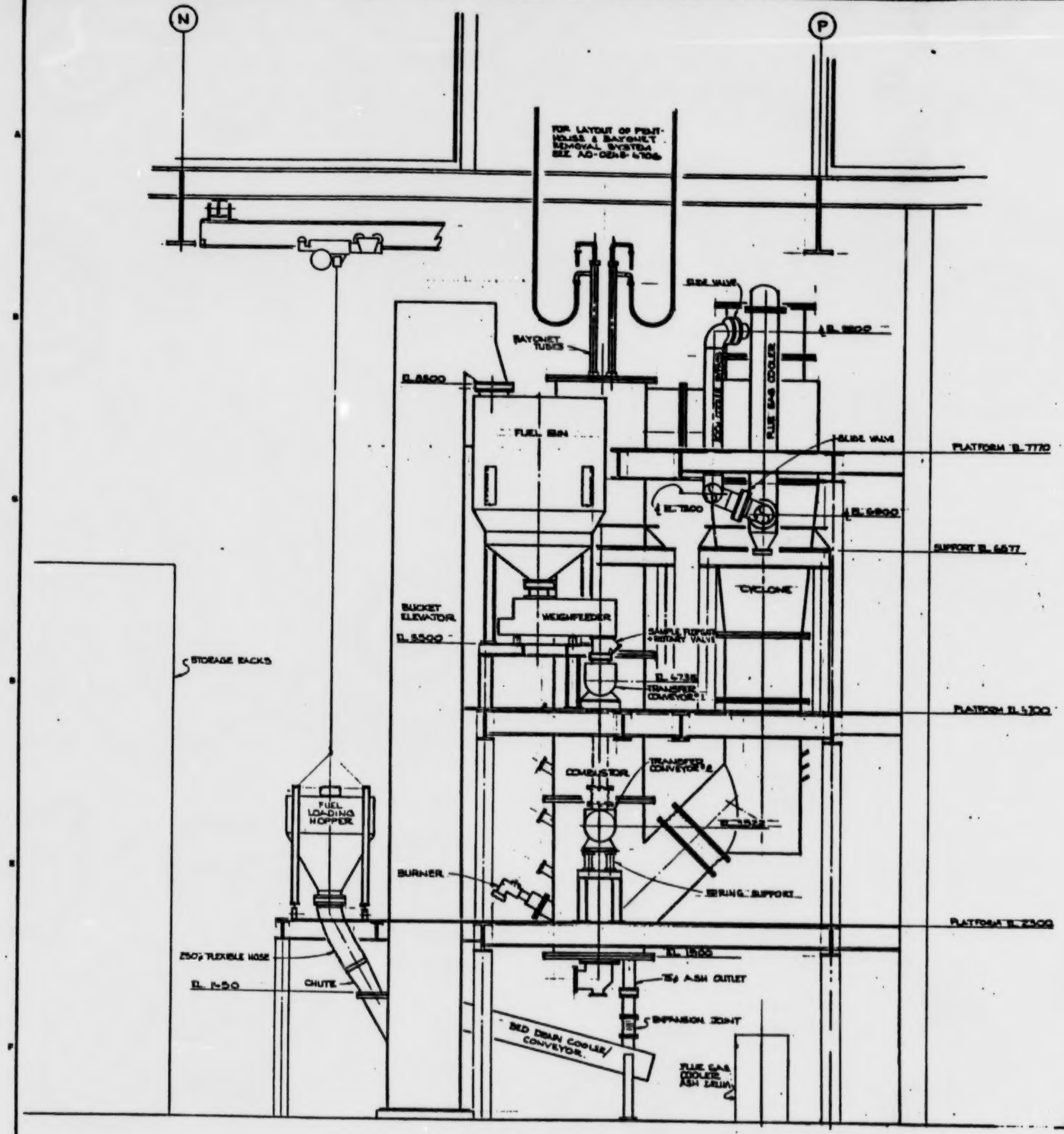
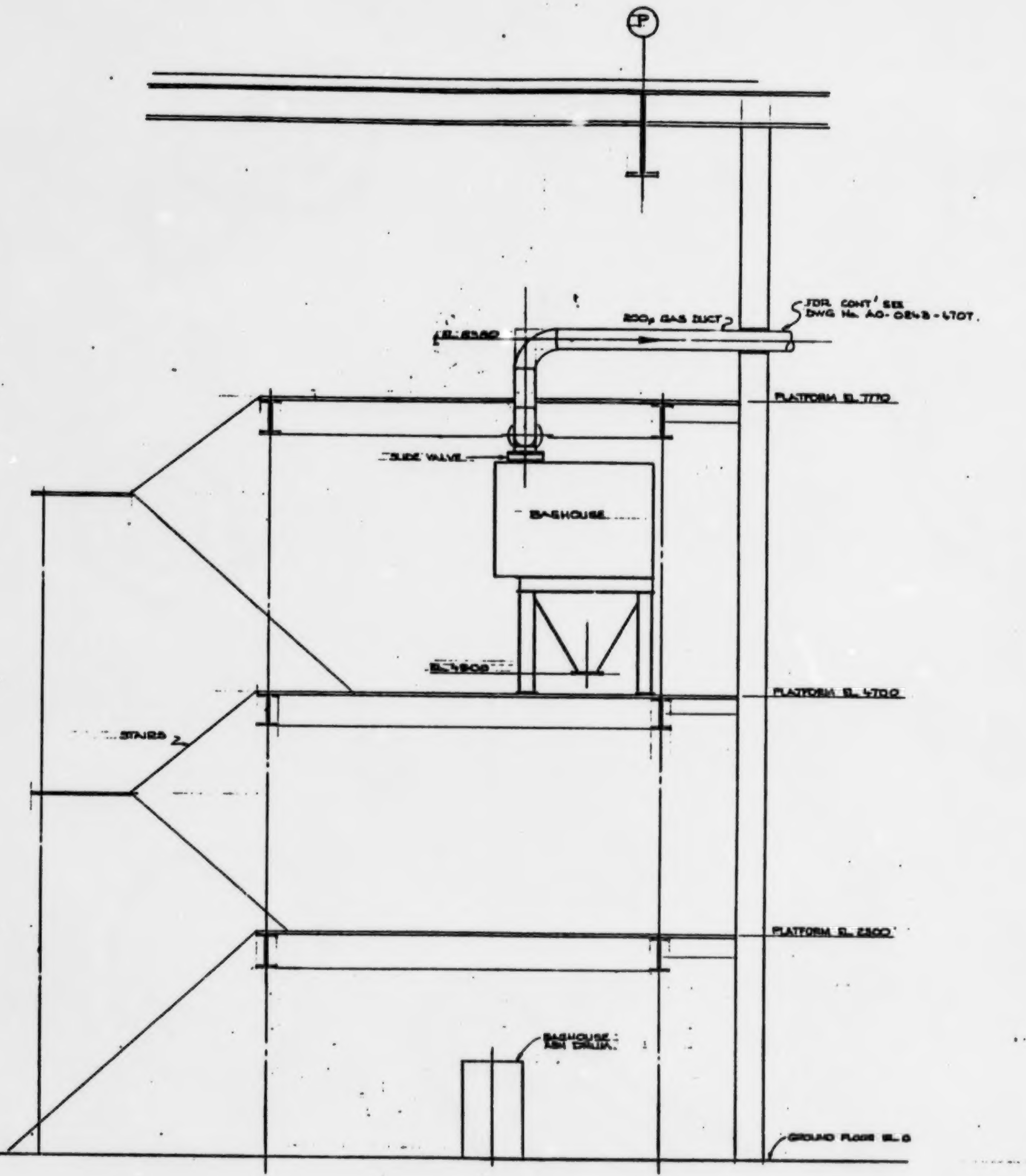
ARFBC RESEARCH FACILITY
GENERAL ARRANGEMENT
SECTION B

L. BELVAK
Scale 1:20

A0 0243 4706 C


N
P
FOR LAYOUT OF PENT-HOUSE & BAYONET REMOVAL SYSTEM SEE AO-0243-4706
SLIDE VALVE
EL 8800
BAYONET TUBES
EL 8500
FUEL BIN
FLUE GAS COOLER
SLIDE VALVE
PLATFORM EL 7770
EL 7300
EL 6900
SUPPORT EL 6577
CYCLONE
BUCKET ELEVATOR
WEIGHFEEDER
EL 5500
SAMPLE FLIPGATE + ROTARY VALVE
EL 4735
TRANSFER CONVEYOR 1
PLATFORM EL 4700
STORAGE SACKS
COMBUSTOR
TRANSFER CONVEYOR 2
FUEL LOADING HOPPER
EL 3322
BURNER
SPRING SUPPORT
PLATFORM EL 2300
EL 1500
250φ FLEXIBLE HOSE
75φ ASH OUTLET
EL 1450
CHUTE
EXPANSION JOINT
BED DRAIN COOLER/ CONVEYOR
FLUE GAS COOLER ASH DRUM

SECTION C C


P
200φ GAS DUCT
FOR CONT' SEE DWG No. AO-0243-4707.
EL 8380
PLATFORM EL 7770
SLIDE VALVE
BAGHOUSE
EL 4900
PLATFORM EL 4700
STAIRS
PLATFORM EL 2300
BAGHOUSE ASH DRUM
GROUND FLOOR EL 0

SECTION D D

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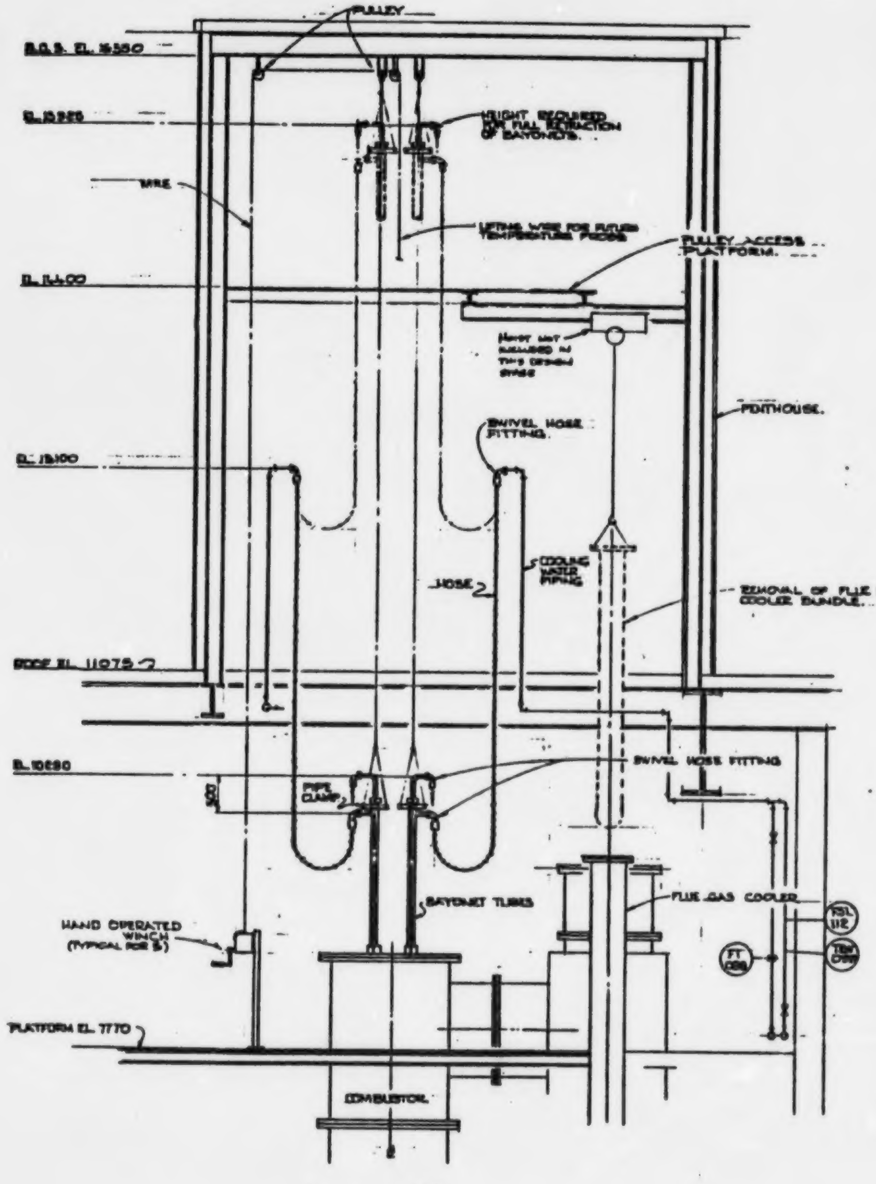
GENERAL ARRANGEMENT
SECTION C & D

Nov 83

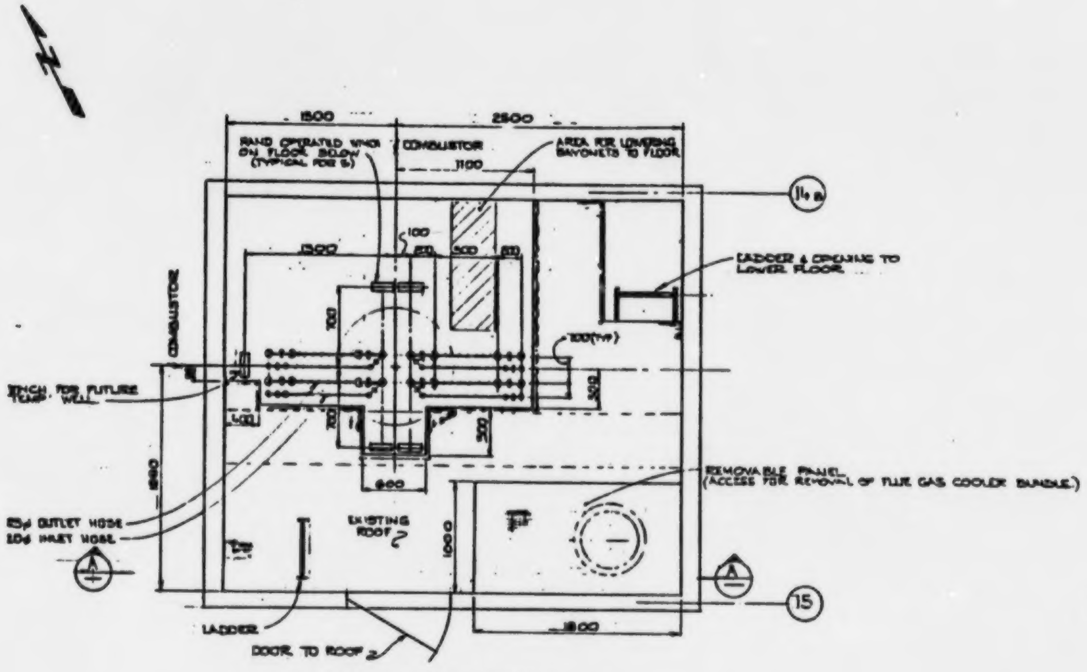
Scale 1:20

AO 0243 — 4708 B

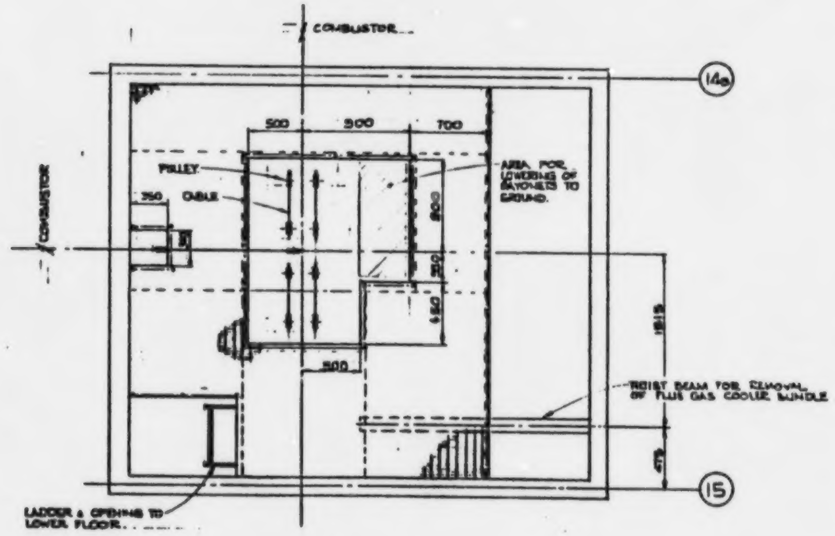
REVIEW		O
MILESTONE ISSUE		A
FINAL REPORT ISSUE		B


PULLEY
B.O.S. EL. 16350
EL. 15925
HEIGHT REQUIRED FOR FULL RETRACTION OF BAYONETS.
WIRE
LIFTING WIRE FOR FUTURE TEMPERATURE PROBES
PULLEY ACCESS PLATFORM.
EL. 14400
HOIST NOT INCLUDED IN THIS DESIGN STAGE
PENTHOUSE.
SWIVEL HOSE FITTING.
EL. 13100
HOSE
COOLING WATER PIPING
REMOVAL OF FLUE GAS COOLER BUNDLE.
ROOF EL. 11075
EL. 10290
SWIVEL HOSE FITTING
PIPE CLAMP
BAYONET TUBES
FLUE GAS COOLER
HAND OPERATED WINCH (TYPICAL FOR 5)
PLATFORM EL. 7770
COMBUSTOR

SECTION A


N
1500
2500
HAND OPERATED WINCH ON FLOOR BELOW (TYPICAL FOR 5)
COMBUSTOR
AREA FOR LOWERING BAYONETS TO FLOOR
1100
LADDER & OPENING TO LOWER FLOOR.
14a
100(TYP)
WINCH FOR FUTURE TEMP. WELL
REMOVABLE PANEL (ACCESS FOR REMOVAL OF FLUE GAS COOLER BUNDLE)
25⌀ OUTLET HOSE
20⌀ INLET HOSE
EXISTING ROOF
LADDER
DOOR TO ROOF
1800
15
A

PLAN - EXISTING ROOF EL 11075.


COMBUSTOR
14a
500
300
700
PULLEY
CABLE
AREA FOR LOWERING OF BAYONETS TO GROUND.
HOIST BEAM FOR REMOVAL OF FLUE GAS COOLER BUNDLE
LADDER & OPENING TO LOWER FLOOR.
15

PLAN - FLOOR EL 14400

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

REVIEW	[illegible]	0
MILESTONE ISSUE	[illegible]	A
FINAL REPORT ISSUE	[illegible]	B

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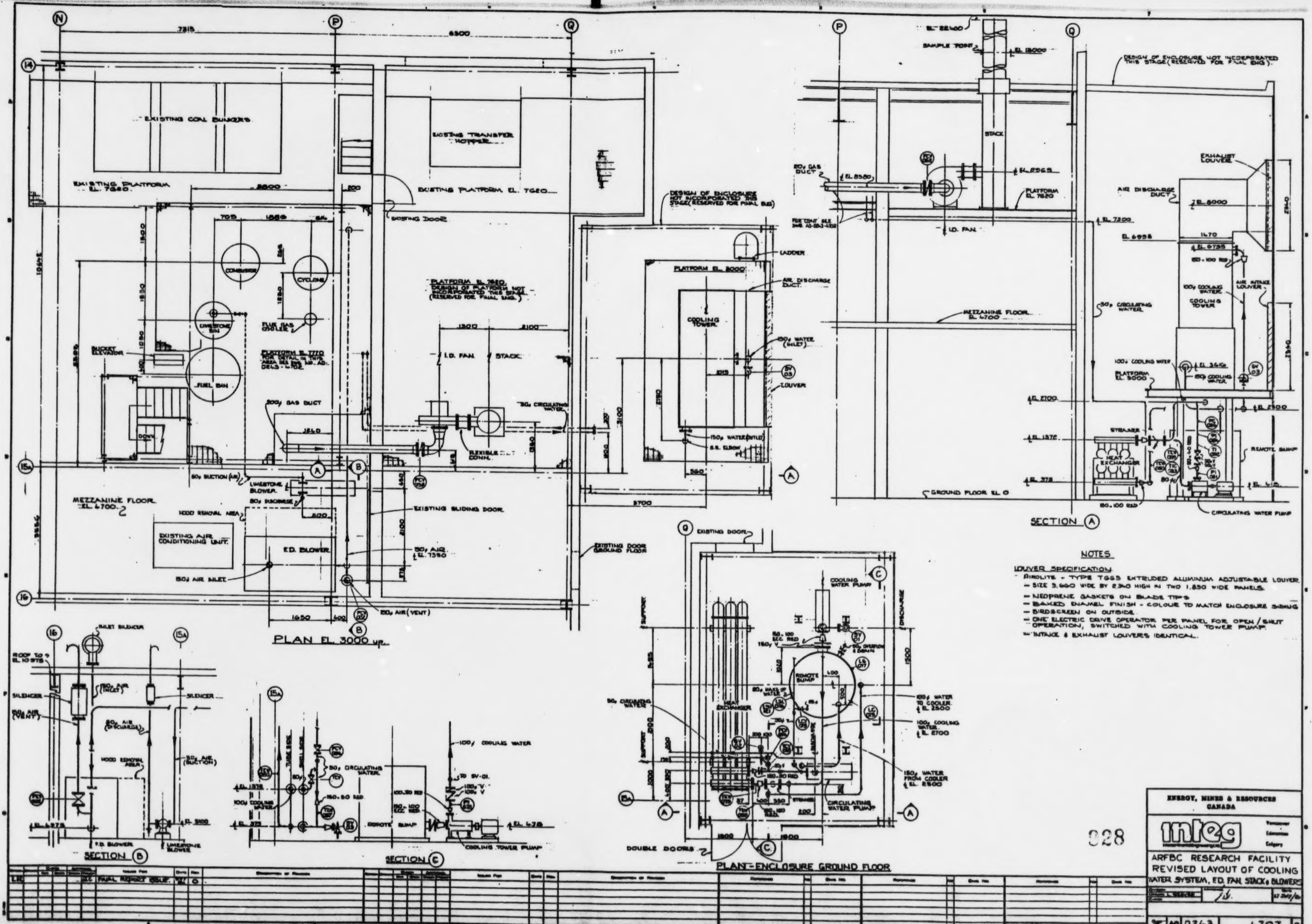
GENERAL ARRANGEMENT
PENTHOUSE & BAYONET TUBE
REMOVAL SYSTEM

L. MARTYN

SCALE 1:20

A0 0243

6706 B


EXISTING COAL BUNKERS
EXISTING TRANSFER HOPPER
EXISTING PLATFORM EL. 7620
EXISTING DOOR
COMBUSTOR
CYCLONE
LIMESTONE BIN
FUEL BIN
BUCKET ELEVATOR
FLUE GAS CYCLONE
PLATFORM EL. 7620. DESIGN OF PLATFORM NOT INCORPORATED THIS STAGE (RESERVED FOR FINAL ENG.)
PLATFORM EL. 7770
I.D. FAN
STACK
200φ GAS DUCT
50φ CIRCULATING WATER
FLEXIBLE CONN.
DESIGN OF ENCLOSURE NOT INCORPORATED THIS STAGE (RESERVED FOR FINAL ENG.)
PLATFORM EL. 3000
LADDER
AIR DISCHARGE DUCT
COOLING TOWER
150φ WATER (INLET)
LOUVER
150φ WATER (OUTLET)
MEZZANINE FLOOR EL. 4700
EXISTING AIR CONDITIONING UNIT
HOOD REMOVAL AREA
LIMESTONE BLOWER
50φ SUCTION (AIR)
50φ DISCHARGE
F.D. BLOWER
150φ AIR INLET
EXISTING SLIDING DOOR
50φ AIR EL. 7350
50φ AIR (VENT)
EXISTING DOOR GROUND FLOOR
PLAN EL. 3000 up
EXHAUST LOUVER
AIR DISCHARGE DUCT
MEZZANINE FLOOR EL. 4700
AIR INTAKE LOUVER
HEAT EXCHANGER
STRAINER
REMOTE SUMP
GROUND FLOOR EL. 0
CIRCULATING WATER PUMP
SECTION A
SAMPLE POINT
EL. 22400
EL. 13000
INLET SILENCER
SILENCER
F.D. BLOWER
LIMESTONE BLOWER
SECTION B
100φ COOLING WATER
50φ CIRCULATING WATER
REMOTE SUMP
COOLING TOWER PUMP
SECTION C
EXISTING DOOR
COOLING WATER PUMP
REMOTE SUMP
HEAT EXCHANGER
100φ WATER TO COOLER EL. 2500
100φ COOLING WATER EL. 2700
150φ WATER FROM COOLER EL. 2500
CIRCULATING WATER PUMP
DOUBLE DOORS
PLAN - ENCLOSURE GROUND FLOOR

NOTES

LOUVER SPECIFICATION.

- AIROLITE - TYPE TGG3 EXTRUDED ALUMINUM ADJUSTABLE LOUVER.
- SIZE 3,660 WIDE BY 2,340 HIGH IN TWO 1,830 WIDE PANELS.
- NEOPRENE GASKETS ON BLADE TIPS
- BAKED ENAMEL FINISH - COLOUR TO MATCH ENCLOSURE SIDING
- BIRDSCREEN ON OUTSIDE.
- ONE ELECTRIC DRIVE OPERATOR PER PANEL FOR OPEN / SHUT OPERATION, SWITCHED WITH COOLING TOWER PUMP.
- INTAKE & EXHAUST LOUVERS IDENTICAL.

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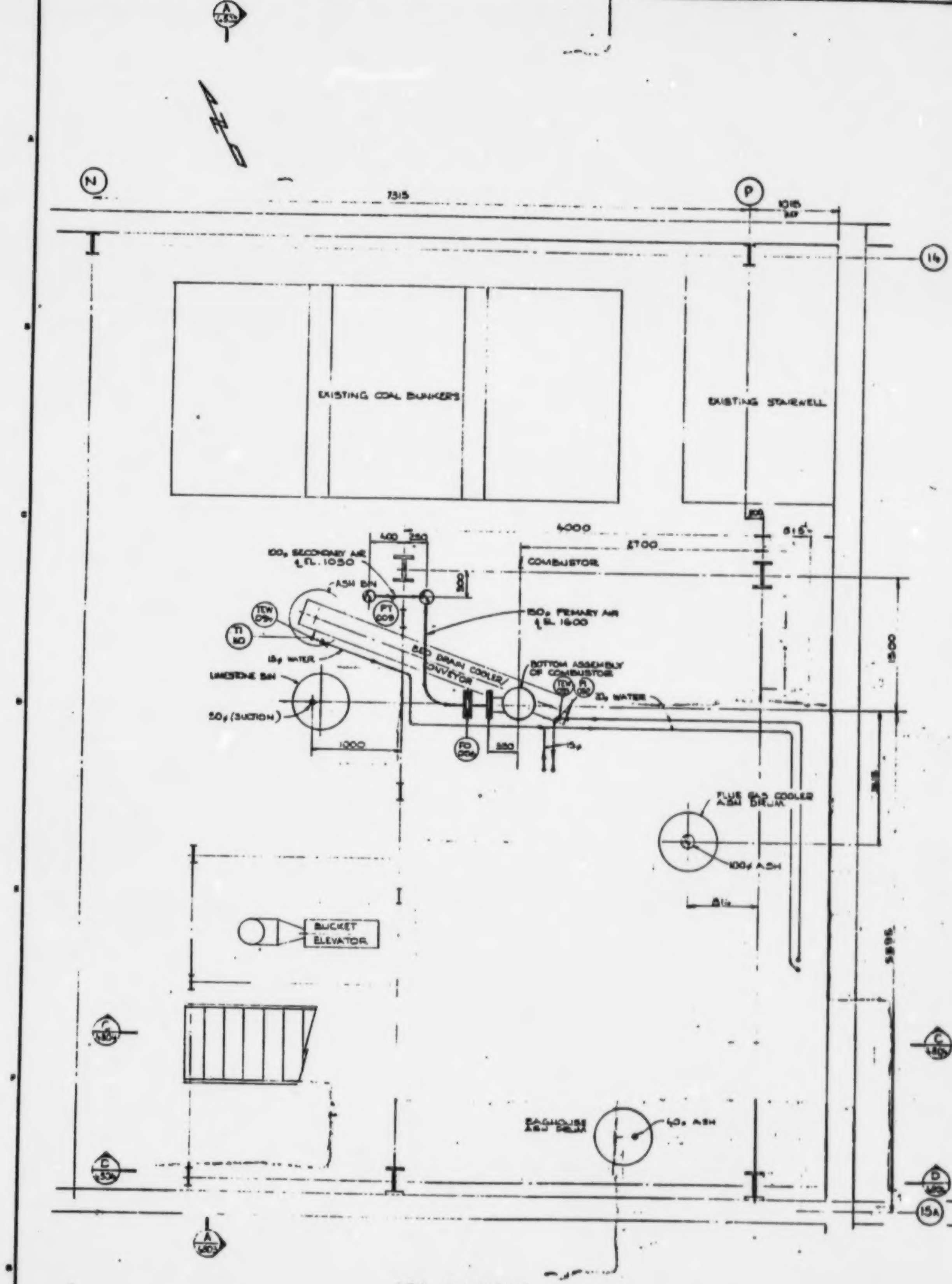
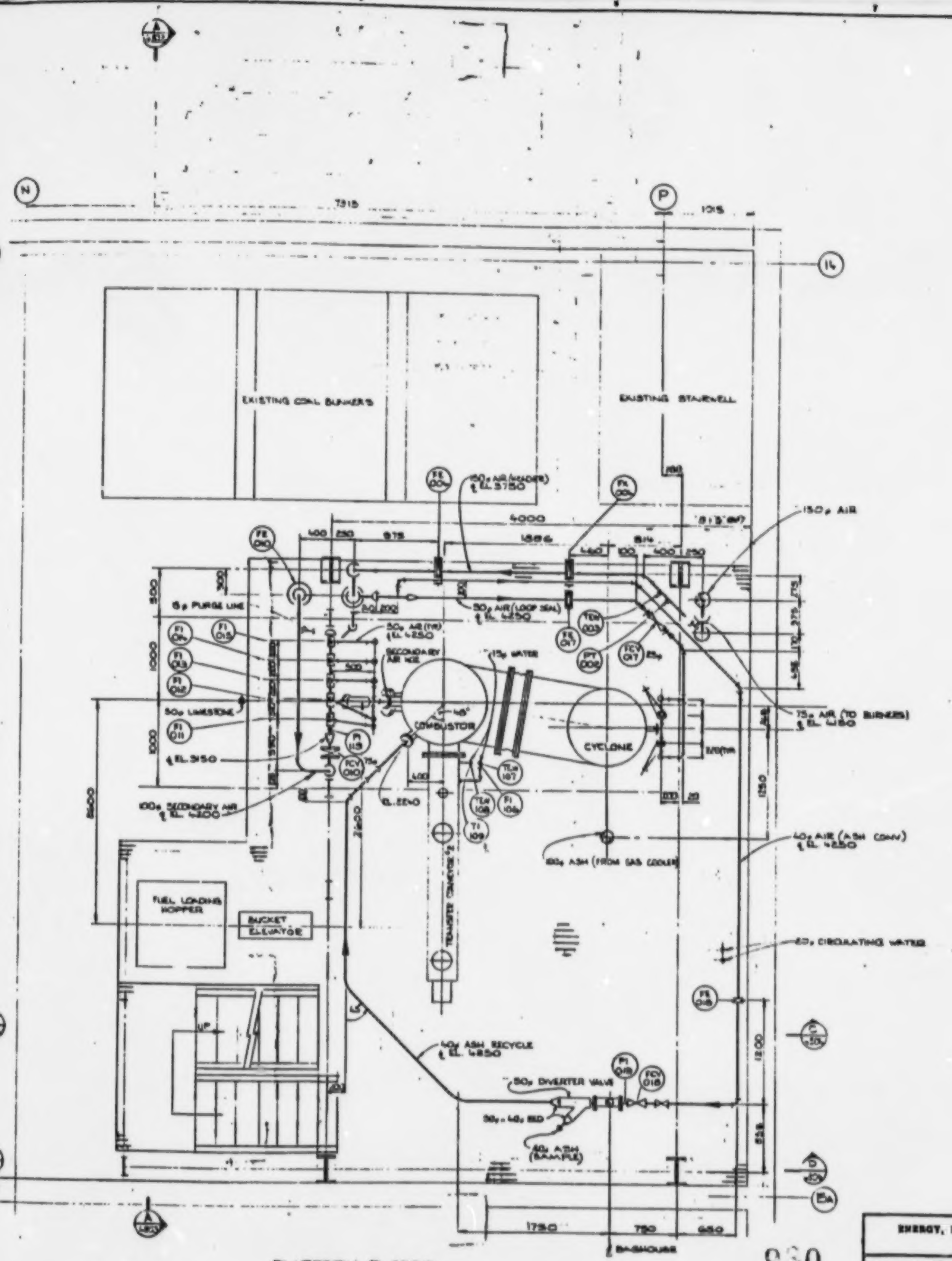
REVISED LAYOUT OF COOLING
WATER SYSTEM, F.D. FAN, STACK & BLOWERS

AO 0243 4707 0


N
P
7315
1015
14
EXISTING COAL BUNKERS
EXISTING STAIRWELL
4000
2700
815
COMBUSTOR
100φ SECONDARY AIR
℄ EL. 1050
ASH BIN
TEW 094
TI 80
PT 009
300
150φ PRIMARY AIR
℄ EL. 1600
BED DRAIN COOLER/ CONVEYOR
BOTTOM ASSEMBLY OF COMBUSTOR
15φ WATER
LIMESTONE BIN
50φ (SUCTION)
20φ WATER
FO 094
1000
250
1500
FLUE GAS COOLER ASH DRUM
100φ ASH
BUCKET ELEVATOR
BAGHOUSE ASH DRUM
40φ ASH
15A

GROUND FLOOR


N
P
7315
1015
14
EXISTING COAL BUNKERS
EXISTING STAIRWELL
FE 004
150φ AIR (HEADER) ℄ EL. 3750
FK 004
4000
150φ AIR
400
250
975
1886
814
FE 010
15φ PURGE LINE
50φ AIR (LOOP SEAL) ℄ EL. 4250
50φ AIR (TYP) ℄ EL. 4250
FI 014
FI 015
FI 013
FI 012
FI 011
50φ LIMESTONE
℄ EL. 3150
SECONDARY AIR HDR
15φ WATER
TEW 003
FE 017
PT 008
FCV 017
FI 113
FCV 010
COMBUSTOR
45°
CYCLONE
TEW 107
TEW 108
FI 104
TI 109
EL. 2240
100φ SECONDARY AIR ℄ EL. 4200
75φ AIR (TO BURNERS) ℄ EL. 4250
40φ AIR (ASH CONV) ℄ EL. 4250
100φ ASH (FROM GAS COOLER)
TRANSFER CONVEYOR
FUEL LOADING HOPPER
BUCKET ELEVATOR
20φ CIRCULATING WATER
FE 018
40φ ASH RECYCLE ℄ EL. 4250
50φ DIVERTER VALVE
FI 018
FCV 018
50φ - 40φ RED
40φ ASH (SAMPLE)
1750
750
650
℄ BAGHOUSE
15A

PLATFORM EL 2300

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

				Issued For	Date	Rev	Description of Revision
	DNB			MILESTONE ISSUE		0	
				FINAL REPORT ISSUE		A	GENERAL

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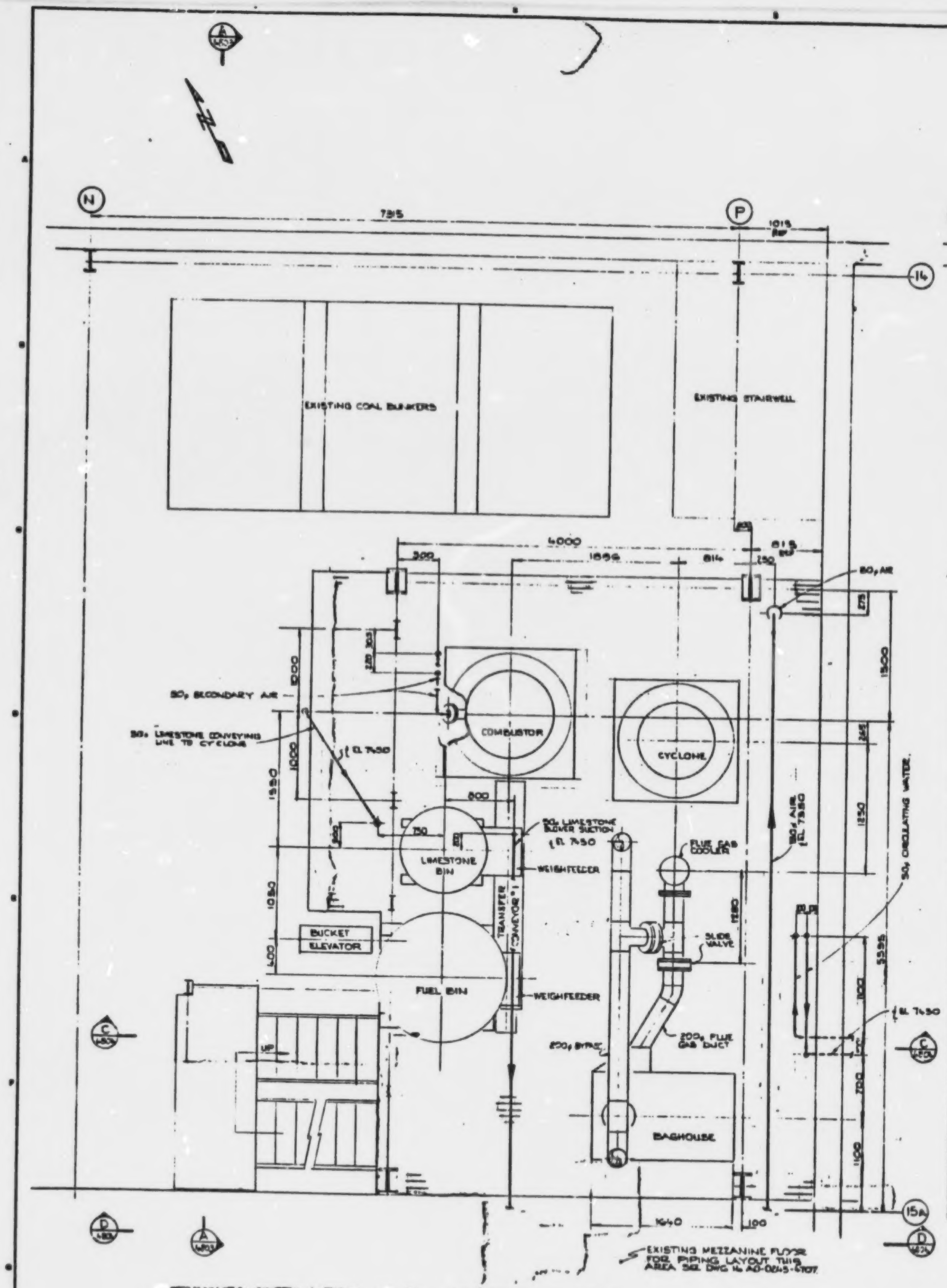
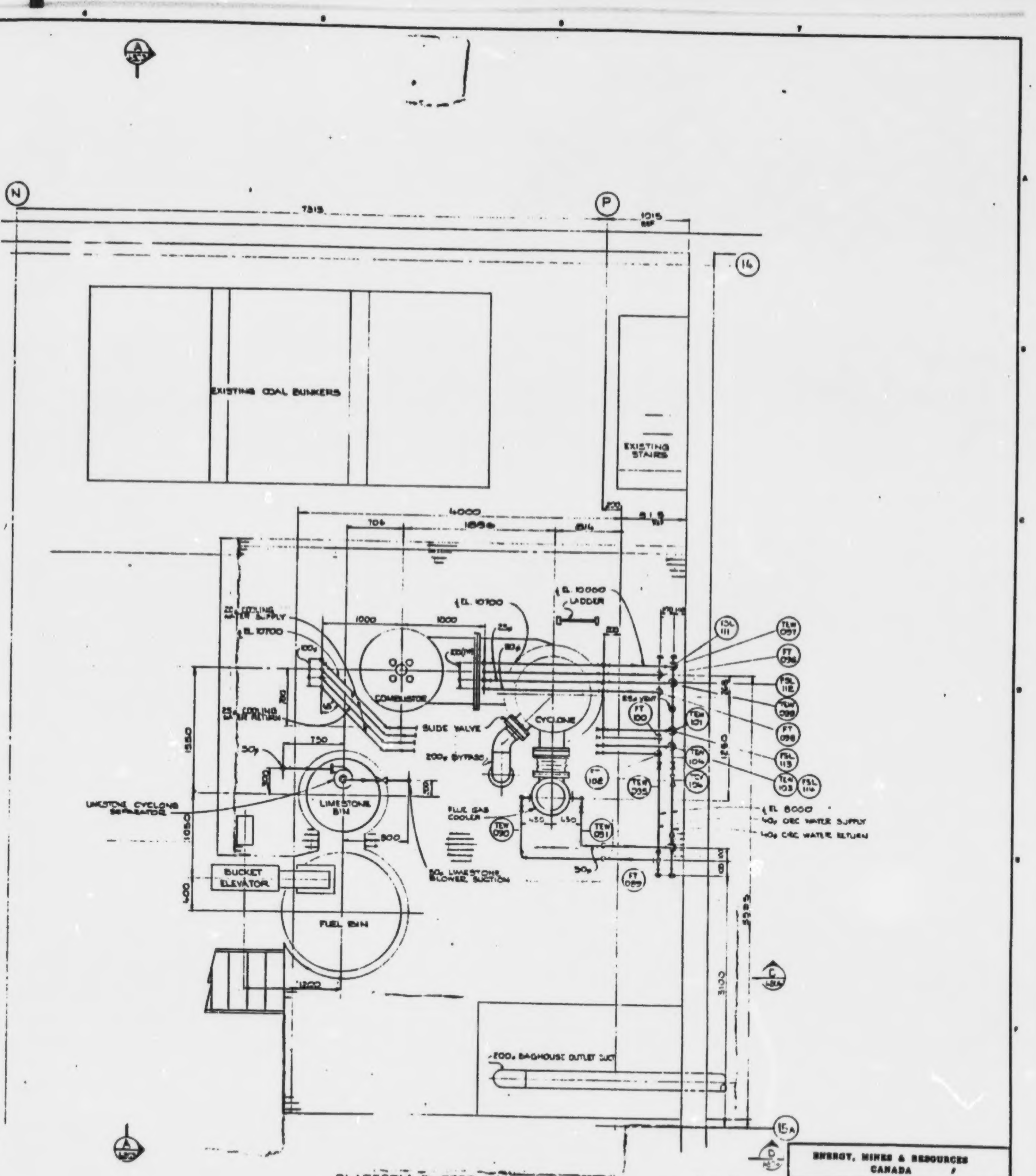
PIPING ARRANGEMENT
GROUND FLOOR & PLATFORM EL 2300

NOV '8

AG 0248 4801 A


N
P
14
15A
7315
1015 REF
EXISTING COAL BUNKERS
EXISTING STAIRWELL
4000
300
1856
814
250
815 REF
80φ AIR
50φ SECONDARY AIR
50φ LIMESTONE CONVEYING LINE TO CYCLONE
℄ EL 7450
COMBUSTOR
CYCLONE
800
750
LIMESTONE BIN
50φ LIMESTONE BLOWER SUCTION
℄ EL 7450
WEIGHFEEDER
TRANSFER CONVEYOR #1
FLUE GAS COOLER
SLIDE VALVE
80φ AIR ℄ EL 7350
50φ CIRCULATING WATER
BUCKET ELEVATOR
FUEL BIN
WEIGHFEEDER
UP
200φ BYPASS
200φ FLUE GAS DUCT
BAGHOUSE
℄ EL 7450
1550
1000
1200
1050
400
1500
1250
1580
5535
720
1100
1640
100
A
C
D
EXISTING MEZZANINE FLOOR FOR PIPING LAYOUT THIS AREA SEE DWG 16 AD-0245-6707

PLATFORM EL 4700


N
P
14
15A
7315
1015 REF
EXISTING COAL BUNKERS
EXISTING STAIRS
4000
706
1856
814
200
815 REF
℄ EL 10700
℄ EL 10000
LADDER
25φ COOLING WATER SUPPLY
℄ EL 10700
1000
1000
100φ
25φ
80φ
COMBUSTOR
25φ COOLING WATER RETURN
SLIDE VALVE
200φ BYPASS
CYCLONE
25φ VENT
FT 100
FT 102
TEW 101
TEW 104
TEW 106
TEW 035
TSL 111
TEW 097
FT 096
FSL 112
TEW 099
FT 098
FSL 113
TEW 103
FSL 114
℄ EL 8000
40φ CIRC WATER SUPPLY
40φ CIRC WATER RETURN
750
50φ
LIMESTONE CYCLONE SEPARATOR
LIMESTONE BIN
300
FLUE GAS COOLER
TEW 090
450
450
TEW 051
50φ
FT 089
50φ LIMESTONE BLOWER SUCTION
1550
1050
400
1250
5383
3100
BUCKET ELEVATOR
FUEL BIN
1200
200φ BAGHOUSE OUTLET DUCT
A
C
D

PLATFORM EL 7770

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PIPING ARRANGEMENT
PLATFORM EL 4700 & 7770

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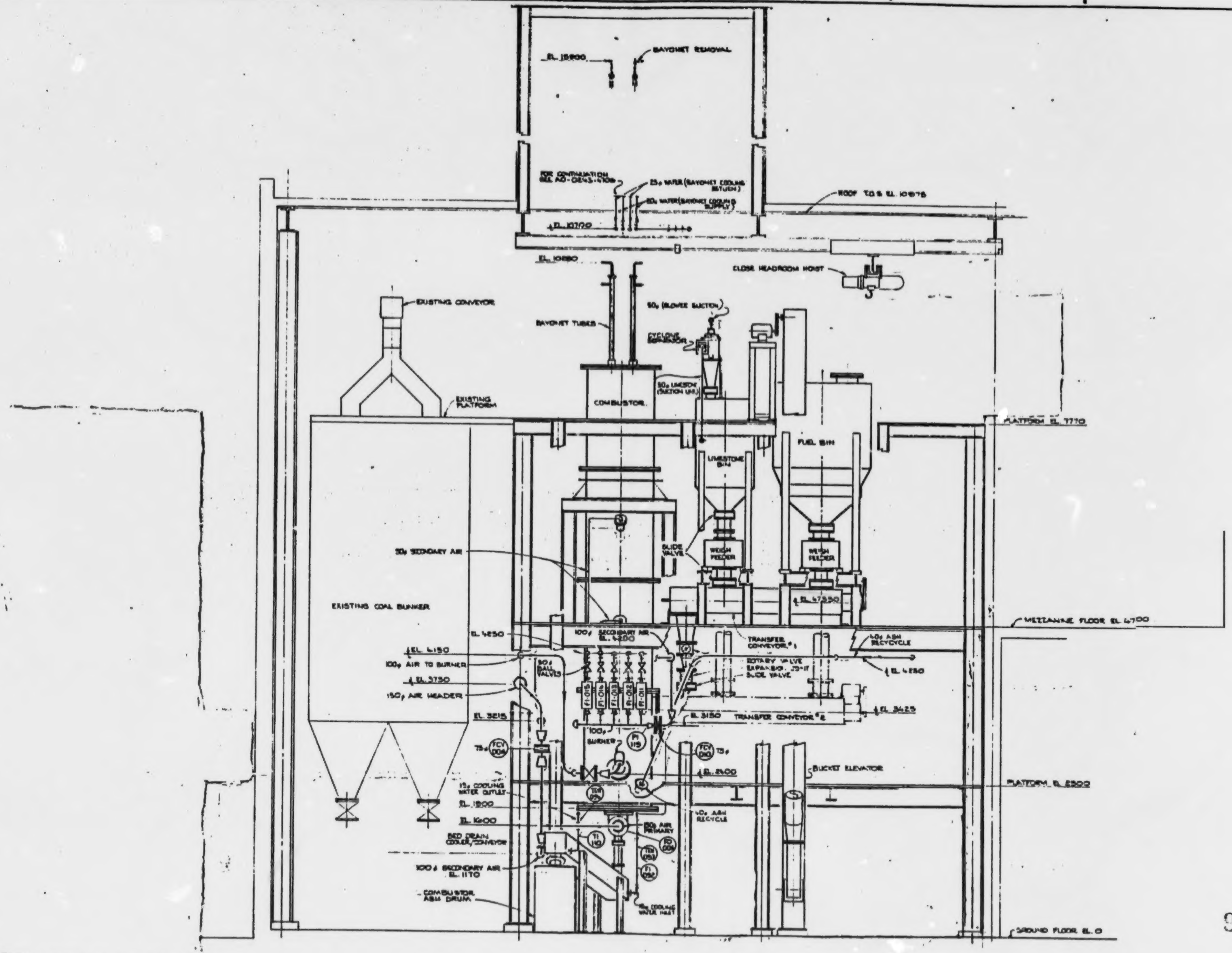
A	FINAL REPORT ISSUE		GENERAL	

931

932


EL. 15900
BAYONET REMOVAL
FOR CONTINUATION SEE AD-0243-4109
25φ WATER (BAYONET COOLING RETURN)
20φ WATER (BAYONET COOLING SUPPLY)
ROOF T.O.S. EL. 10975
EL. 10700
EL. 10280
CLOSE HEADROOM HOIST
EXISTING CONVEYOR
BAYONET TUBES
50φ (BLOWER SUCTION)
CYCLONE SEPARATOR
50φ LIMESTONE (SUCTION UNIT)
EXISTING PLATFORM
COMBUSTOR
PLATFORM EL. 7770
LIMESTONE BIN
FUEL BIN
SLIDE VALVE
WEIGH FEEDER
WEIGH FEEDER
50φ SECONDARY AIR
EXISTING COAL BUNKER
EL. 47550
MEZZANINE FLOOR EL. 4700
EL. 4250
100φ SECONDARY AIR EL. 4200
TRANSFER CONVEYOR #1
40φ ASH RECYCLE
EL. 4150
100φ AIR TO BURNER
50φ BALL VALVES
ROTARY VALVE
EXPANSION JOINT
SLIDE VALVE
EL. 4250
EL. 3750
150φ AIR HEADER
FI-015
FI-016
FI-013
FI-012
FI-011
EL. 3215
EL. 3150
TRANSFER CONVEYOR #2
EL. 3425
100φ
BURNER
FI 115
75φ FCV 004
FCV 010 75φ
EL. 2400
BUCKET ELEVATOR
15φ COOLING WATER OUTLET
TEE 051
PLATFORM EL. 2300
EL. 1900
EL. 1600
40φ ASH RECYCLE
150φ AIR PRIMARY
BED DRAIN COOLER/CONVEYOR
TI 110
FO 006
TEE 052
100φ SECONDARY AIR EL. 1170
FI 050
COMBUSTOR ASH DRUM
15φ COOLING WATER INLET
GROUND FLOOR EL. 0

SECTION A A

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SECTION A

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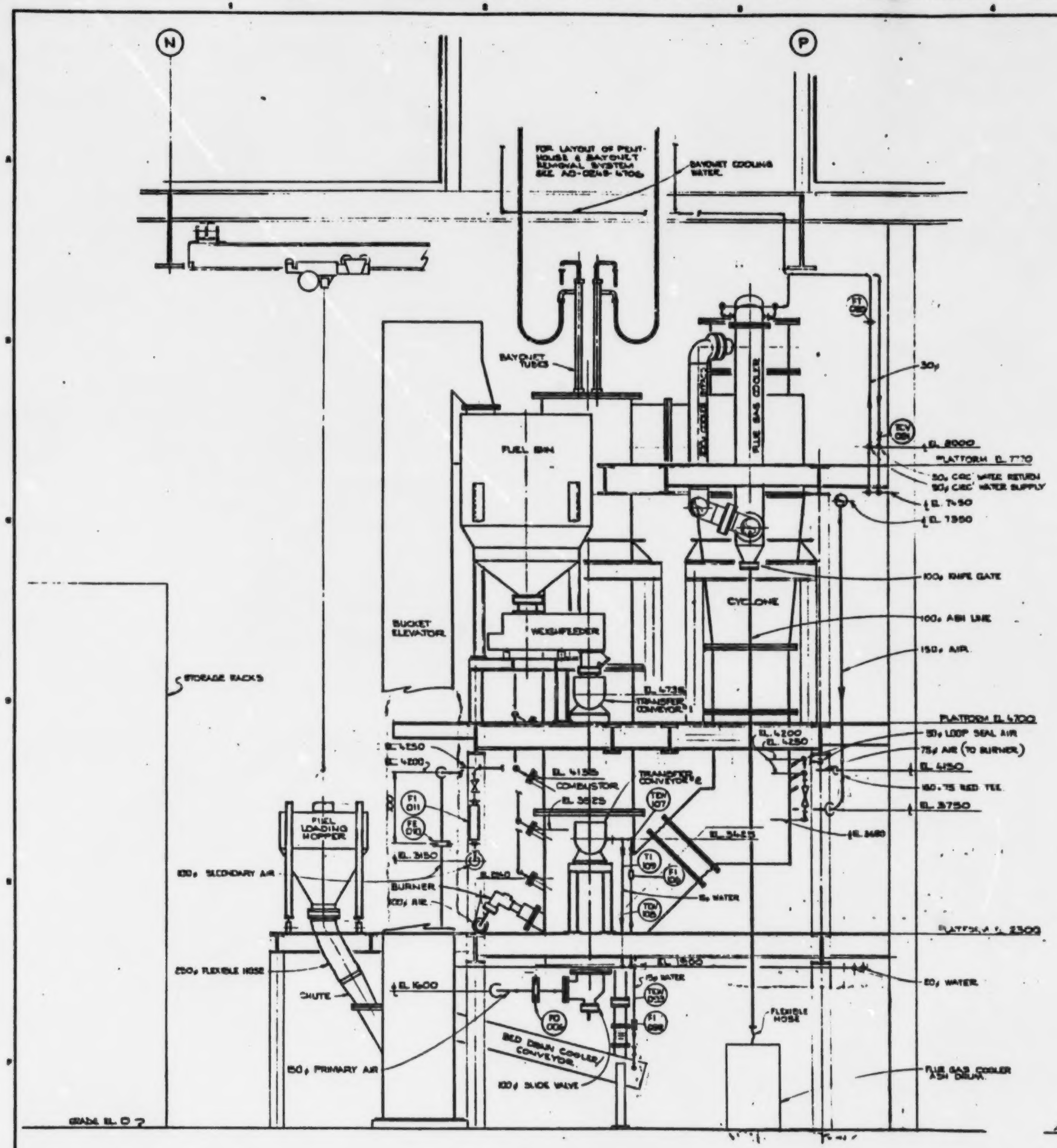
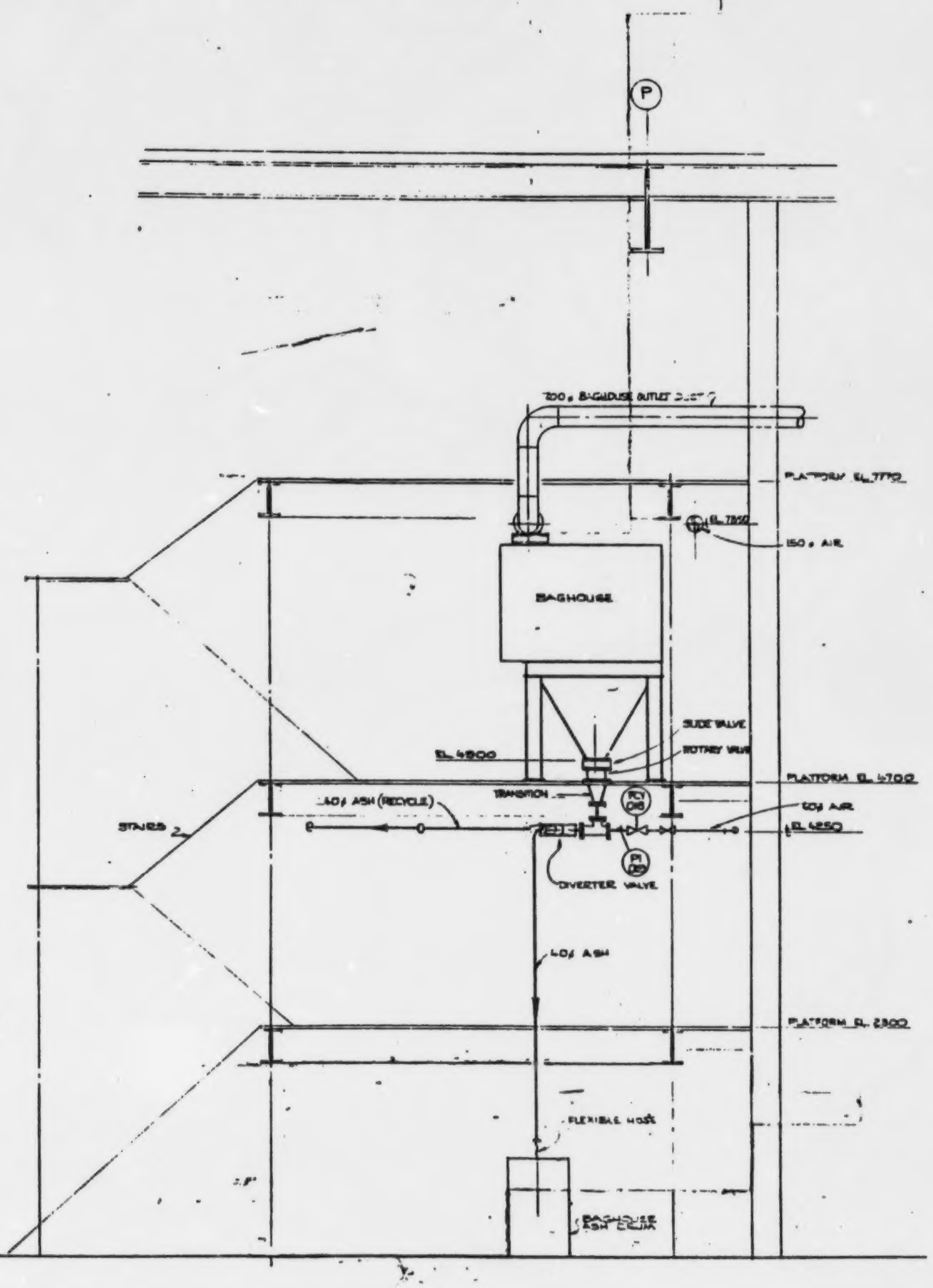
MILESTONE ISSUE	0		
LR.	FINAL REPORT ISSUE	A	GENERAL


N
P
FOR LAYOUT OF PENT-HOUSE & BAYONET REMOVAL SYSTEM SEE AD-0248-4706
BAYONET COOLING WATER
BAYONET TUBES
FUEL BIN
FLUE GAS COOLER
FI 026
30ϕ
TCV 031
EL 8000
PLATFORM EL 7770
50ϕ CIRC' WATER RETURN
50ϕ CIRC' WATER SUPPLY
EL 7450
EL 7350
100ϕ KNIFE GATE
CYCLONE
100ϕ ASH LINE
150ϕ AIR
BUCKET ELEVATOR
WEIGHFEEDER
EL 4735
TRANSFER CONVEYOR 1
STORAGE RACKS
PLATFORM EL 4700
50ϕ LOOP SEAL AIR
75ϕ AIR (TO BURNER)
EL 4200
EL 4250
EL 4150
150×75 RED TEE
EL 3750
EL 3480
EL 4250
EL 4200
EL 4135
COMBUSTOR
TRANSFER CONVEYOR 2
EL 3625
FI 011
FE 010
TCV 107
EL 3425
FUEL LOADING HOPPER
EL 3150
100ϕ SECONDARY AIR
EL 2240
BURNER
100ϕ AIR
TI 109
FI 106
15ϕ WATER
TCV 105
PLATFORM EL 2300
EL 1800
20ϕ WATER
250ϕ FLEXIBLE HOSE
EL 1600
15ϕ WATER
TCV 033
CHUTE
FO 004
FI 032
FLEXIBLE HOSE
BED DRAIN COOLER/CONVEYOR
150ϕ PRIMARY AIR
100ϕ SLIDE VALVE
FLUE GAS COOLER ASH DRUM
GRADE EL 0

SECTION C C


P
200ϕ BAGHOUSE OUTLET DUCT
PLATFORM EL 7770
EL 7350
150ϕ AIR
BAGHOUSE
SLIDE VALVE
ROTARY VALVE
EL 4900
PLATFORM EL 4700
TRANSITION
40ϕ ASH (RECYCLE)
FCV 018
50ϕ AIR
EL 4250
STAIRS
PI 019
DIVERTER VALVE
40ϕ ASH
PLATFORM EL 2300
FLEXIBLE HOSE
BAGHOUSE ASH DRUM

SECTION D D

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

LR	DB				MILESTONE ISSUE		0	
JR					FINAL REPORT ISSUE		A	GENERAL

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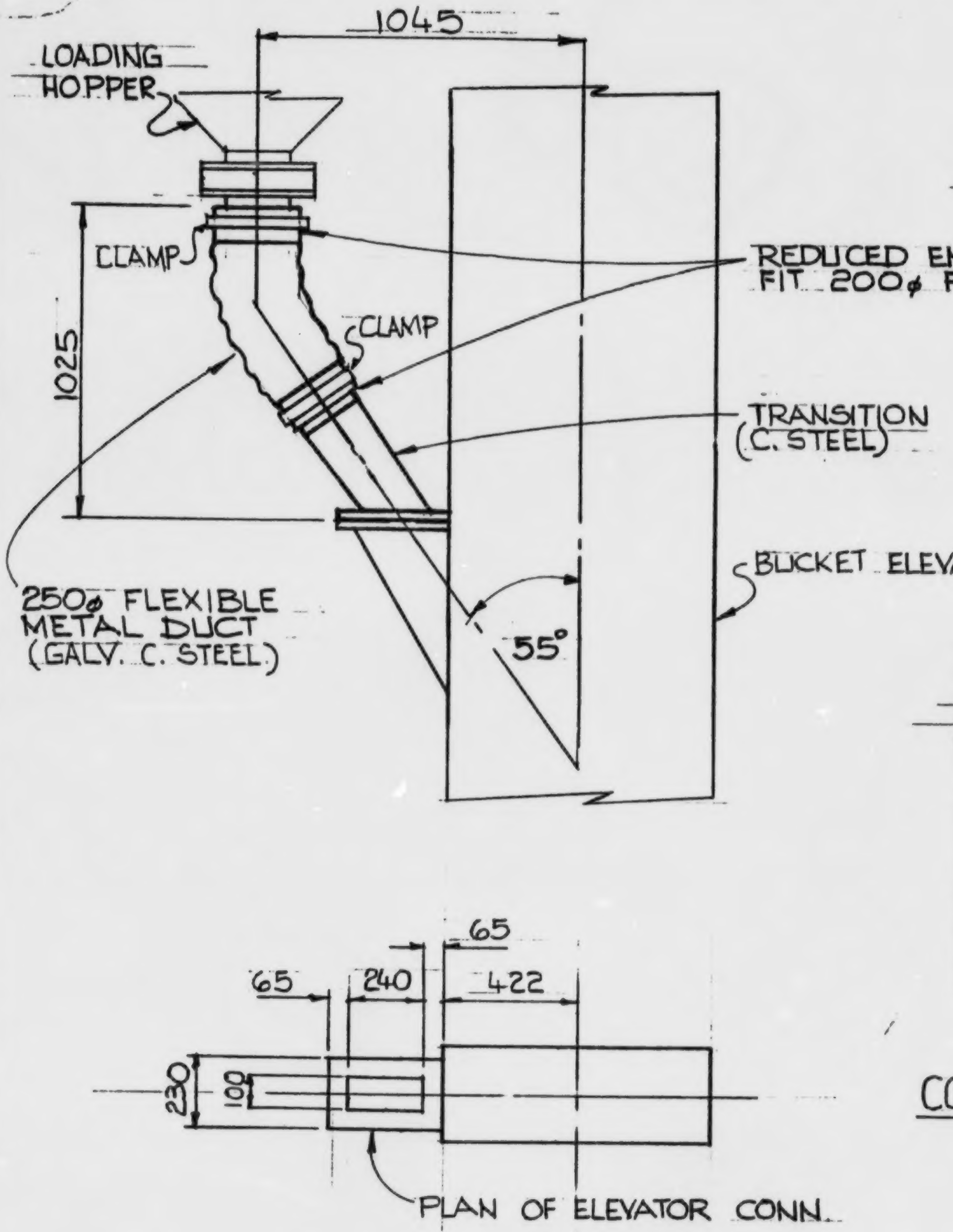
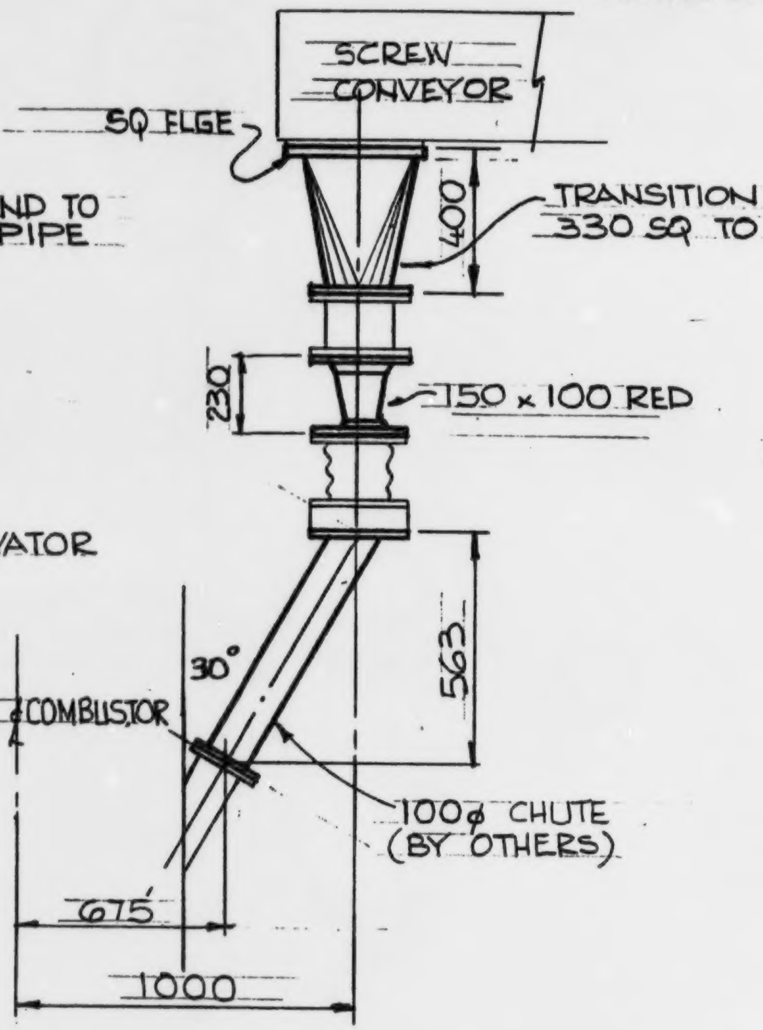
SECTION C & D

AD 0248 4804 A

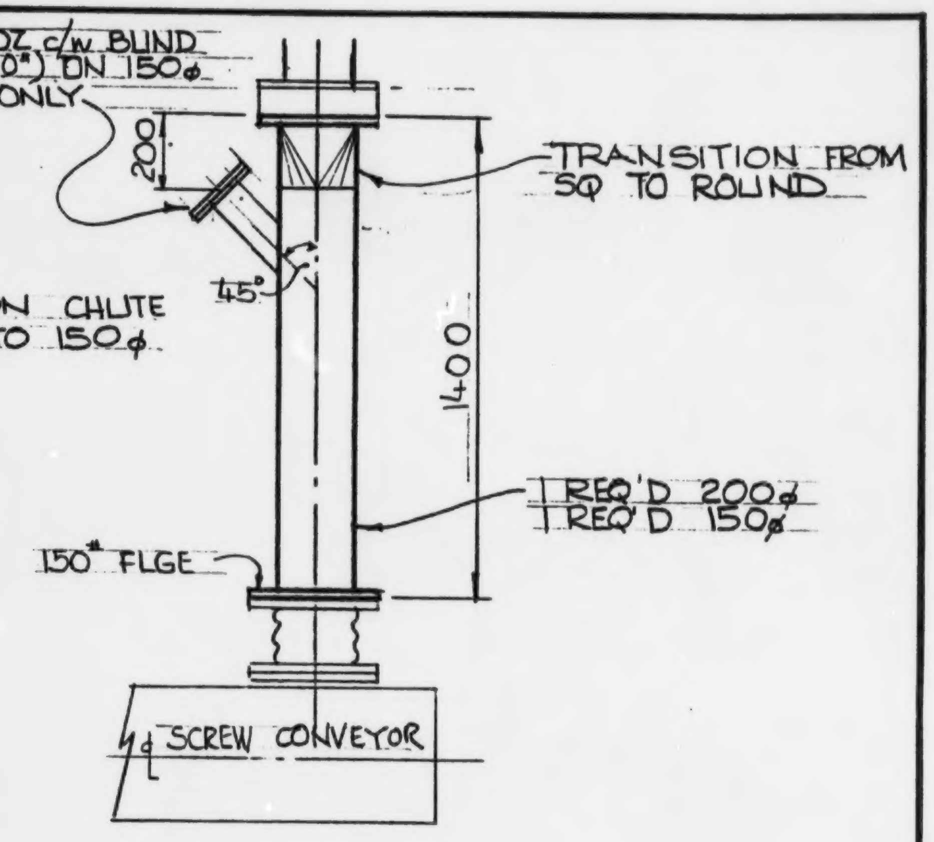

1045
LOADING HOPPER
CLAMP
1025
CLAMP
REDUCED END TO FIT 200ø PIPE
TRANSITION (C. STEEL)
BUCKET ELEVATOR
250ø FLEXIBLE METAL DUCT (GALV. C. STEEL)
55°
65
240
65
422
230
100
PLAN OF ELEVATOR CONN.

BUCKET ELEVATOR LOADING CHUTE

837


SCREW CONVEYOR
SQ FLGE
400
TRANSITION CHUTE 330 SQ TO 150ø
230
150 x 100 RED
563
30°
℄ COMBUSTOR
100ø CHUTE (BY OTHERS)
675
1000

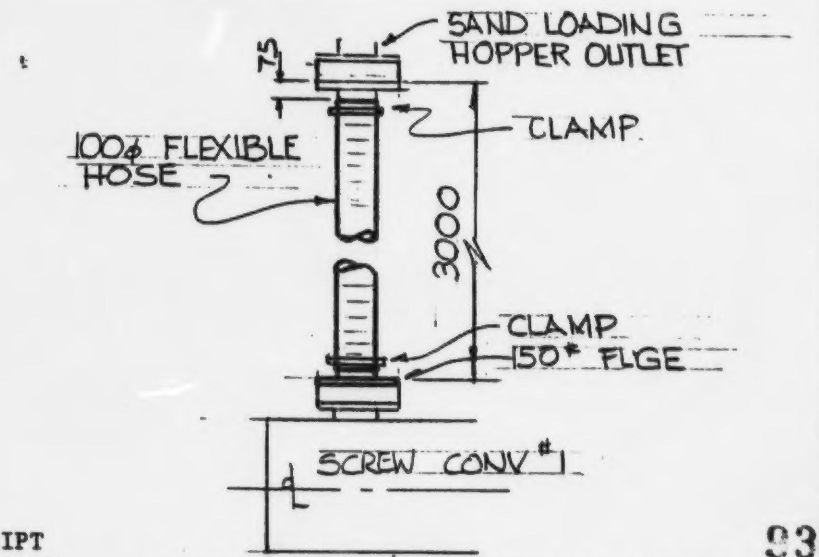
COMBUSTOR FUEL FEED CHUTE


100ø NOZ c/w BLIND FLGE (150#) ON 150ø CHUTE ONLY
200
45°
TRANSITION FROM SQ TO ROUND
1400
1 REQ'D 200ø
1 REQ'D 150ø
150# FLGE
℄ SCREW CONVEYOR

CONVEYOR #2 FEED CHUTE

NOTE. PIPE FLANGES 150#.
CHUTE MATERIAL TO BE
C. STEEL, LIGHT WALL SCH.
(UNLESS NOTED OTHERWISE).

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".


75
SAND LOADING HOPPER OUTLET
CLAMP
100ø FLEXIBLE HOSE
3000
CLAMP
150# FLGE
℄ SCREW CONV #1

SAND LOADING CHUTE

838

Design	Drawn	Check	Appd	Issued for	Date	Rev
LR.			GKC	MILESTONE ISSUE	DEC 16/83	0
LR.			GKC	FINAL REPORT ISSUE	27/7/84	A

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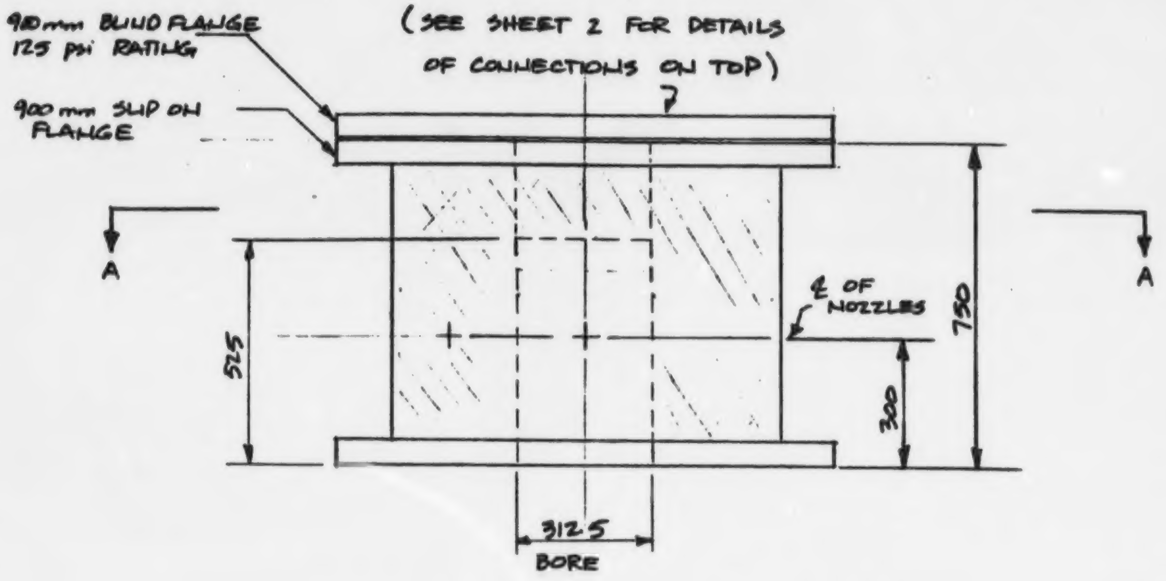
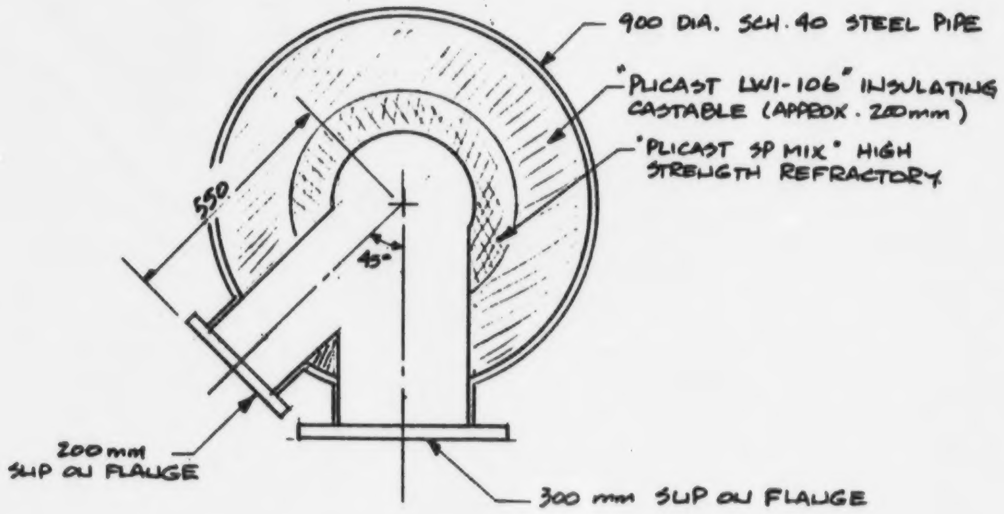
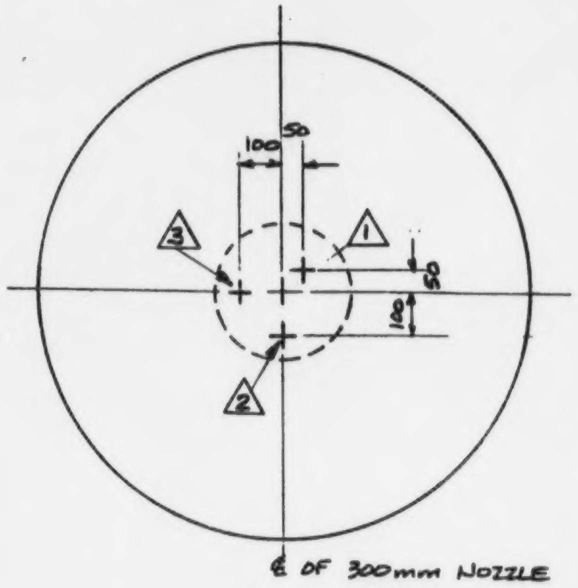
ARFBC RESEARCH FACILITY
FUEL LOADING & FEED CHUTES

B 0243 SK 231-3 A


910 mm BLIND FLANGE
125 psi RATING
(SEE SHEET 2 FOR DETAILS
OF CONNECTIONS ON TOP)
900 mm SLIP ON
FLANGE
A
A
℄ OF
NOZZLES
525
300
750
312.5
BORE


900 DIA. SCH. 40 STEEL PIPE
"PLICAST LWI-106" INSULATING
CASTABLE (APPROX. 200mm)
"PLICAST SP MIX" HIGH
STRENGTH REFRACTORY
550
45°
200 mm
SLIP ON FLANGE
300 mm SLIP ON FLANGE

SECTION A-A


100
50
3
1
50
18
2
℄ OF 300mm NOZZLE

DETAIL OF BLIND FLANGE

CONNECTIONS

- △1 50 mm (2" NPT) THREADED HALF COUPLING WITH CAP.
- △2 19 mm (¾" NPT) THREADED HALF COUPLING.
- △3 25 mm (1" NPT) THREADED HALF COUPLING.

ALL CONNECTIONS EXTEND THROUGH THE REFRACTORY LINING

NOTE: SECTION INSTALLED ON TOP OF CYCLONE.

Design	Drawn	Check	Appd	Issued for	Date	Rev
			GRC	FINAL REPORT ISSUE		

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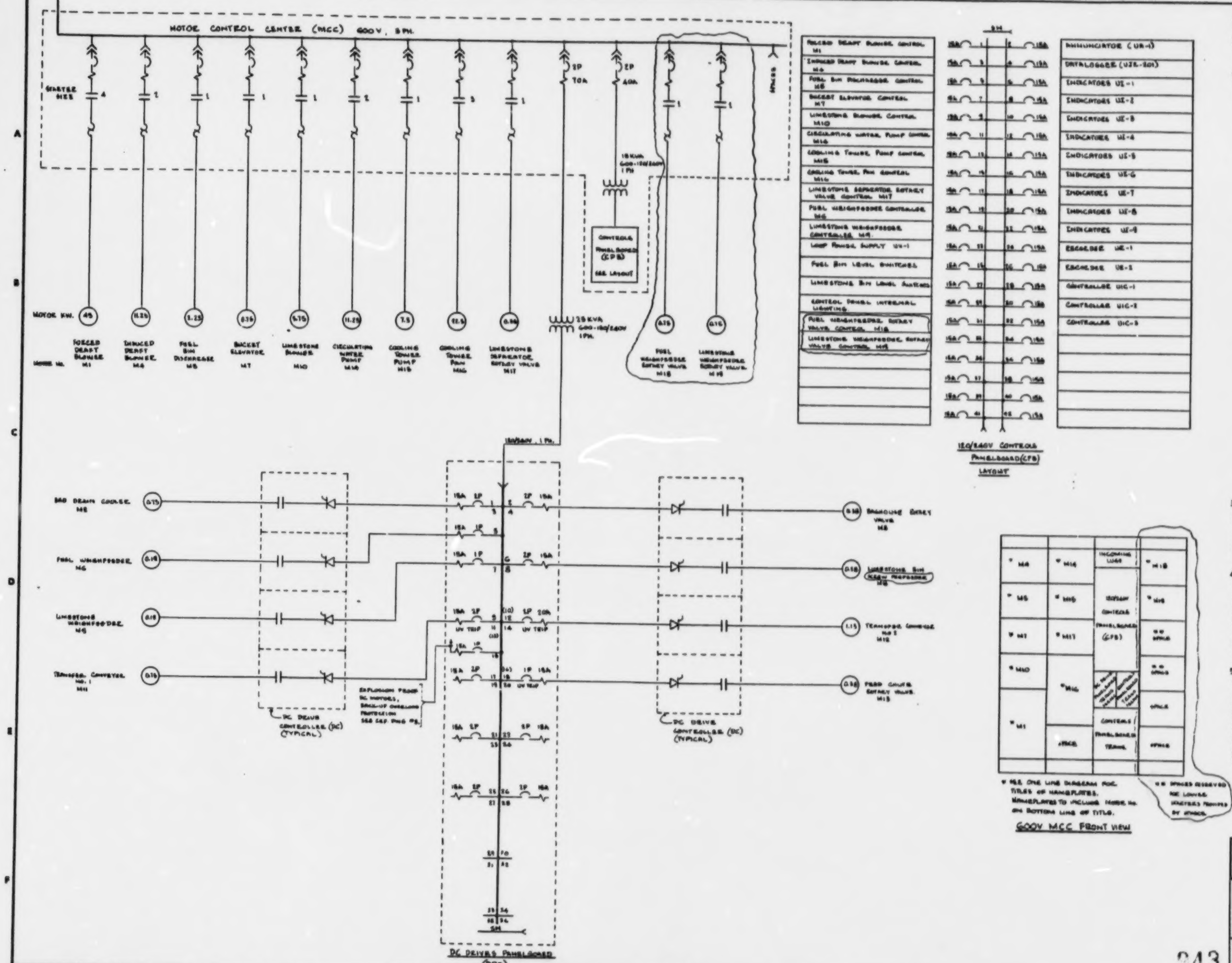
FLUE GAS BREECHING
REFRACTORY LINED DUCT SECTION

B	0243	SK	172-1	0

ELECTRICAL

Electrical


MOTOR CONTROL CENTER (MCC) 600V, 3PH.
STARTER SIZE
4
2
1
1
1
2
1
3
1
2P 70A
2P 40A
SPACE
15KVA 600-120/240V 1PH
CONTROLS PANELBOARD (CPB)
SEE LAYOUT
MOTOR KW.
45
11.25
2.25
0.75
5.75
11.25
7.5
22.5
0.56
0.75
0.75
25KVA 600-120/240V 1PH.
FORCED DRAFT BLOWER M1
INDUCED DRAFT BLOWER M4
FUEL BIN DISCHARGE M5
BUCKET ELEVATOR M7
LIMESTONE BLOWER M10
CIRCULATING WATER PUMP M14
COOLING TOWER PUMP M15
COOLING TOWER FAN M16
LIMESTONE SEPARATOR ROTARY VALVE M17
FUEL WEIGHFEEDER ROTARY VALVE M18
LIMESTONE WEIGHFEEDER ROTARY VALVE M19
MOTOR No.
FORCED DRAFT BLOWER CONTROL M1
INDUCED DRAFT BLOWER CONTROL M4
FUEL BIN DISCHARGE CONTROL M5
BUCKET ELEVATOR CONTROL M7
LIMESTONE BLOWER CONTROL M10
CIRCULATING WATER PUMP CONTROL M14
COOLING TOWER PUMP CONTROL M15
COOLING TOWER FAN CONTROL M16
LIMESTONE SEPARATOR ROTARY VALVE CONTROL M17
FUEL WEIGHFEEDER CONTROLLER M6
LIMESTONE WEIGHFEEDER CONTROLLER M9
LOOP POWER SUPPLY UY-1
FUEL BIN LEVEL SWITCHES
LIMESTONE BIN LEVEL SWITCHES
CONTROL PANEL INTERNAL LIGHTING
FUEL WEIGHFEEDER ROTARY VALVE CONTROL M18
LIMESTONE WEIGHFEEDER ROTARY VALVE CONTROL M19
SN
15A
ANNUNCIATOR (UA-1)
DATALOGGER (UJR-201)
INDICATORS UI-1
INDICATORS UI-2
INDICATORS UI-3
INDICATORS UI-4
INDICATORS UI-5
INDICATORS UI-6
INDICATORS UI-7
INDICATORS UI-8
INDICATORS UI-9
RECORDER UR-1
RECORDER UR-2
CONTROLLER UIC-1
CONTROLLER UIC-2
CONTROLLER UIC-3
120/240V CONTROLS PANELBOARD (CPB) LAYOUT
120/240V, 1PH.
BAG DRAIN COOLER M2
FUEL WEIGHFEEDER M6
LIMESTONE WEIGHFEEDER M9
TRANSFER CONVEYOR No. 1 M11
0.75
0.19
0.19
0.75
15A 2P
15A 1P
UV TRIP
20A
EXPLOSION PROOF DC MOTORS, BACK-UP OVERLOAD PROTECTION SEE SEP. DWG #2.
DC DRIVE CONTROLLER (DC) (TYPICAL)
DC DRIVES PANELBOARD (DPB)
BAGHOUSE ROTARY VALVE M3
LIMESTONE BIN WEIGHFEEDER M8
TRANSFER CONVEYOR No 2 M12
FEED CHUTE ROTARY VALVE M13
0.38
0.38
1.15
0.38
INCOMING LUGS
* M4
* M5
* M7
* M10
* M1
* M14
* M15
* M17
* M16
SPACE
120/240V CONTROLS PANELBOARD (CPB)
CONTROLS PANELBOARD TRANS.
* M18
* M19
** SPACE
SPACE
* SEE ONE LINE DIAGRAM FOR TITLES OF NAMEPLATES. NAMEPLATES TO INCLUDE MOTOR No. ON BOTTOM LINE OF TITLE.
** SPACES RESERVED FOR LOUVRE MOTORS REMOVED BY OTHERS.
600V MCC FRONT VIEW

NOTES:

1. ALL ELECTRICAL EQUIPMENT TO BE IN ACCORDANCE WITH THE LATEST REVISION OF ALL APPLICABLE ANSI, EEMAC, NEMA AND CSA STANDARDS, UNLESS OTHERWISE NOTED.

2. MOTOR CONTROL CENTRE TO BE AS MANUFACTURED BY ALLEN-BRADLEY, CUTLER-HAMMER, GENERAL ELECTRIC, SQUARE D OR WESTINGHOUSE, AND TO BE AS FOLLOWS:
   - A. MCC TO BE APPROXIMATELY 2285 HIGH, WITH APPROX. 510 WIDE VERTICAL SECTIONS, MOUNTED ON A FULL LENGTH CHANNEL BASE.
   - B. STARTERS, FEEDER BREAKERS AND CONTROLS PANELBOARD TO BE FRONT MOUNTED. MCC TO BE ARRANGED FOR FRONT ONLY ACCESS.
   - C. MAIN BUS TO BE TIN PLATED COPPER, 600A FOR MAIN HORIZONTAL BUS AND 300A FOR VERTICAL BUS IN EACH SECTION. VERTICAL BUSES TO BE LOCATED BEHIND INSULATING ISOLATING BARRIER.
   - D. MAIN BUS (HORIZONTAL AND VERTICAL) TO BE BRACED FOR 42,000A RMS SYMMETRICAL FAULT, UNLESS FAULT LEVEL AT MCC IS HIGHER IN WHICH CASE ADDITIONAL ADEQUATE BUS BRACING IS REQUIRED.
   - E. CIRCUIT BREAKERS IN MOTOR STARTERS TO BE WESTINGHOUSE TYPE MCP, OR APPROVED EQUAL, WITH INTERRUPTING RATING IN MASTERS OF 18,000A RMS SYMMETRICAL AT 600V AC, UNLESS FAULT LEVEL AT MCC IS HIGHER IN WHICH CASE BREAKERS TO BE WESTINGHOUSE TYPE MCP-CL (I.E. WITH CURRENT LIMITER), OR APPROVED EQUAL.
   - F. FEEDER BREAKERS TO BE WESTINGHOUSE TYPE FB, OR APPROVED EQUAL, WITH INTERRUPTING RATING OF 14,000A RMS SYMMETRICAL AT 600V AC, UNLESS FAULT LEVEL AT MCC IS HIGHER IN WHICH CASE BREAKERS TO BE WESTINGHOUSE TYPE HFB OR APPROVED EQUAL, UP TO 18,000A RMS SYMMETRICAL AT 600V AC, AND ABOVE THIS TO BE WESTINGHOUSE TYPE FB-CL (I.E. WITH CURRENT LIMITER), OR APPROVED EQUAL.
   - G. CONTROLS PANELBOARD BREAKERS TO BE BOLT-IN QUICKLAG TYPE, WITH INTERRUPTING RATING OF 10,000A RMS SYMMETRICAL AT 120V AC.
   - H. POWER AND CONTROL WIRING TO BE EEMAC CLASS I TYPE B.
   - I. GROUND BUS TO BE 6 x 25 TIN PLATED COPPER, FOR FULL LENGTH OF MCC, WITH GROUND LUG FOR 1/0 STRANDED COPPER.
   - J. ENCLOSURE TO BE EEMAC TYPE 1A SEMI-DUST TIGHT (GASKETTED).
   - K. EXTERIOR FINISH TO BE ANSI 61 LIGHT GREY ENAMEL, INTERIOR FINISH TO BE WHITE ENAMEL.
   - L. STARTER AND FEEDER BREAKER DOORS, AND CONTROLS PANELBOARD TO BE EQUIPPED WITH LAMACOID NAMEPLATES.

3. DC DRIVES TRANSFORMER TO BE WESTINGHOUSE TYPE EP OR APPROVED EQUAL, 25KVA, 600-120/240V, 1 PHASE, CLASS F OR H INSULATED WITH 115°C MAXIMUM TEMPERATURE RISE, EPOXY ENCAPSULATED, WITH 4-2½ % VOLTAGE FULL CAPACITY PRIMARY TAPS, 2 ABOVE AND 2 BELOW RATED VOLTAGE, IN DUST TIGHT (NON-VENTILATED) ENCLOSURE. TRANSFORMER IS POWER SUPPLY FOR STATIC DRIVES.

4. DC DRIVES PANELBOARD TO BE WESTINGHOUSE TYPE NEB, WITH TYPE EB CIRCUIT BREAKERS, OR APPROVED EQUAL, 120/240V, 1 PHASE, WITH 225A MAIN LUGS, BOX AND SURFACE TRIM, AND LAMACOID NAMEPLATES. BREAKERS TO HAVE INTERRUPTING RATING OF 10,000A RMS SYMMETRICAL AT 120 AND 240V AC. BREAKER HANDLES TO BE PADLOCKABLE IN 'OFF' POSITION. UNDERVOLTAGE TRIP COILS TO BE 120V AC AND WIRED TO DESIGNATED BRANCH CIRCUIT BREAKER AND OUTGOING TERMINAL BLOCK. PAINT FINISH TO BE ANSI 61 LIGHT GREY ON BOX AND TRIM.

5. DC DRIVE CONTROLLERS ENCLOSURE TO BE HAMMOND CAT. 1422 RB, OR APPROVED EQUAL, EEMAC AND NEMA TYPE 12 (INDUSTRIAL USE) AND CSA ENCLOSURE 5 (DUST TIGHT), 1372 HIGH BY 1067 WIDE BY 305 DEEP, FOR WALL MOUNTING, WITH REMOVABLE INTERIOR PANEL FOR MOUNTING BY INSTALLATION CONTRACTOR OF 6 DC DRIVE CONTROLLERS PLUS SPACE FOR 3 ADDITIONAL CONTROLLERS. GASKETTED HINGED DOUBLE FRONT DOORS WITH AUTOMOTIVE TYPE HANDLE AND 3-POINT LATCH, EXTERIOR FINISH OF ANSI 61 LIGHT GREY ENAMEL AND INTERIOR FINISH OF WHITE ENAMEL.

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

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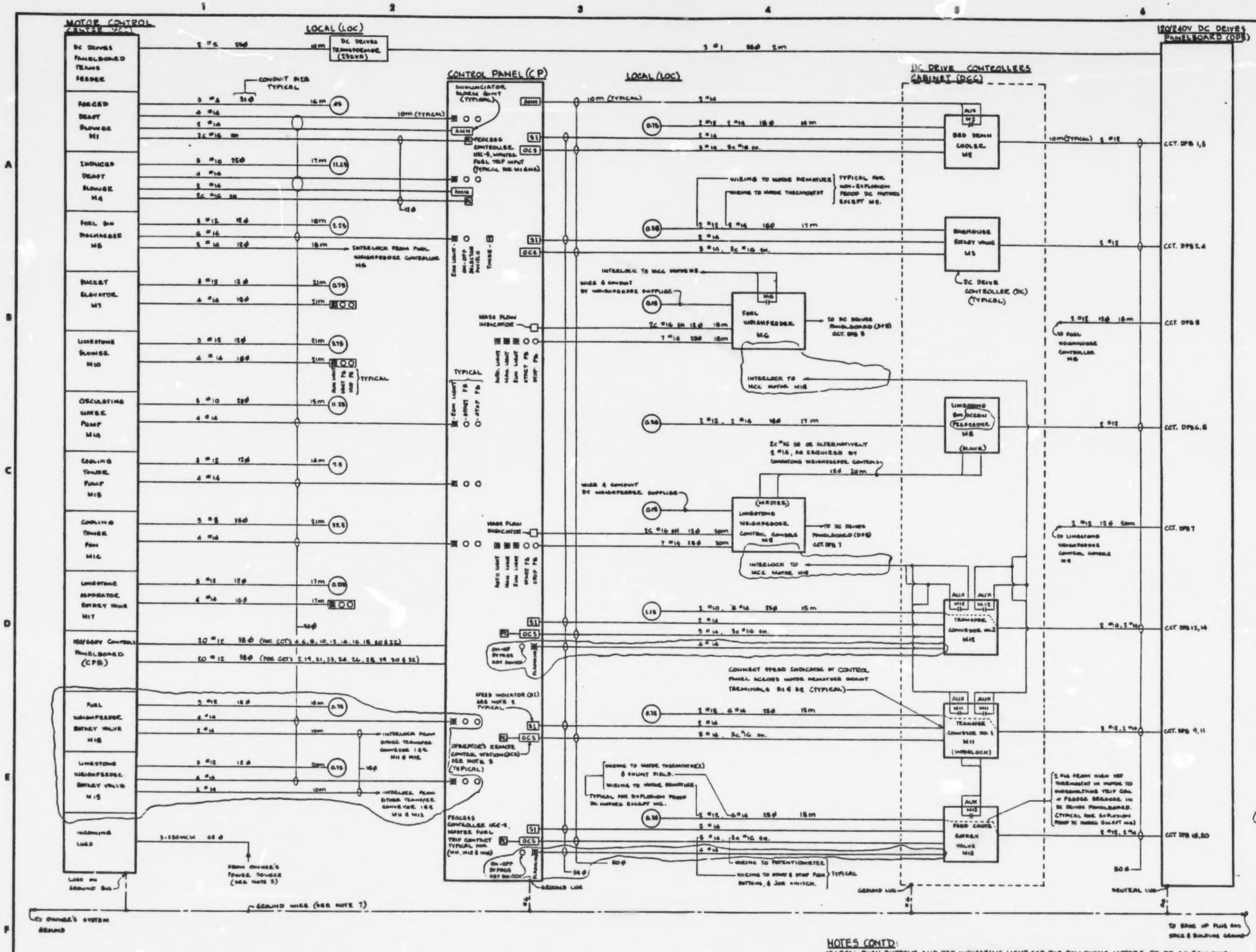
ARFBC RESEARCH FACILITY
ONE LINE DIAGRAM

Design	Drawn	Check Dwg	Check Design	Approval Design	Approval Project	Issued For	Date	Rev	Description of Revision
EWW	ECG	RCI	CDW		GC	MILESTONE ISSUE	[illegible]	0	
RGS	ECG	RCI				FINAL REPORT ISSUE		A	

Reference	No	Dwg No
SCHEMATIC DIAGRAMS	3	A1-0243-7601
MOTOR LIST SH 2 OF 2	2	A-0243-1602
MOTOR LIST SH 1 OF 2	1	A-0243-1601

DRAWING NUMBER A1 0243 6101 A


1
2
3
4
5
6
7
A
B
C
D
E
F
MOTOR CONTROL CENTER (MCC)
DC DRIVES PANELBOARD TRANS FEEDER
FORCED DRAFT BLOWER M1
INDUCED DRAFT BLOWER M4
FUEL BIN DISCHARGER M6
BUCKET ELEVATOR M7
LIMESTONE BLOWER M10
CIRCULATING WATER PUMP M14
COOLING TOWER PUMP M15
COOLING TOWER FAN M16
LIMESTONE SEPARATOR ROTARY VALVE M17
120/208V CONTROLS PANELBOARD (CPB)
FUEL WEIGHFEEDER ROTARY VALVE M18
LIMESTONE WEIGHFEEDER ROTARY VALVE M19
INCOMING LUGS
LUGS ON GROUND BUS
TO OWNER'S SYSTEM GROUND
GROUND WIRE (SEE NOTE 7)
FROM OWNER'S POWER SOURCE (SEE NOTE 5)
3-250MCM 68 ø
LOCAL (LOC)
DC DRIVES TRANSFORMER (25KVA)
CONDUIT SIZE TYPICAL
10m (TYPICAL)
INTERLOCK FROM FUEL WEIGHFEEDER CONTROLLER M6
TYPICAL
20 #12 38 ø (FOR CCTS 4,6,8,10,12,14,16,18,20 & 22)
20 #12 38 ø (FOR CCTS 2,19,21,23,24,26,28,29,30 & 32)
INTERLOCK FROM EITHER TRANSFER CONVEYOR 1 & 2 M11 & M12
CONTROL PANEL (CP)
ANNUNCIATOR ALARM POINT (TYPICAL)
ANN
PROCESS CONTROLLER UIC-4, MASTER FUEL TRIP INPUT (TYPICAL FOR M1 & M4)
MASS FLOW INDICATOR
SPEED INDICATOR (SI) SEE NOTE 3 TYPICAL
OPERATOR'S REMOTE CONTROL STATION (OCS) SEE NOTE 3 (TYPICAL)
PROCESS CONTROLLER UIC-4, MASTER FUEL TRIP CONTACT TYPICAL FOR (M11, M12 & M18)
ON-OFF BYPASS KEY SWITCH
GROUND LUG
SI
OCS
INTERLOCK TO MCC MOTORS
WIRE & CONDUIT BY WEIGHFEEDER SUPPLIER
FUEL WEIGHFEEDER M6
TO DC DRIVES PANELBOARD (DPB) CCT. DPB 5
INTERLOCK TO MCC MOTOR M18
LIMESTONE WEIGHFEEDER CONTROL CONSOLE M9
INTERLOCK TO MCC MOTOR M19
WIRING TO MOTOR REMAINS TYPICAL FOR NON-EXPLOSION PROOF DC MOTORS EXCEPT M8
CONNECT SPEED INDICATOR IN CONTROL PANEL ACROSS MOTOR ARMATURE RIGHT TERMINALS A1 & A2 (TYPICAL)
WIRING TO POTENTIOMETER
WIRING TO START & STOP PUSH BUTTONS, & JOG SWITCH.
DC DRIVE CONTROLLERS CABINET (DCC)
BED DRAIN COOLER M2
BAGHOUSE ROTARY VALVE M3
DC DRIVE CONTROLLER (DC) (TYPICAL)
LIMESTONE BIN SCREW FEEDER M8
TRANSFER CONVEYOR NO. 2 M12
TRANSFER CONVEYOR NO. 1 M11 (INTERLOCK)
FEED CHUTE ROTARY VALVE M13
AUX
GROUND LUG
NEUTRAL LUG
120/240V DC DRIVES PANELBOARD (DPB)
CCT. DPB 1,3
CCT. DPB 2,4
CCT. DPB 5
CCT. DPB 6,8
CCT. DPB 7
CCT DPB 12,14
CCT. DPB 9,11
CCT DPB 18,20
TO FUEL WEIGHFEEDER CONTROLLER M6
TO LIMESTONE WEIGHFEEDER CONTROL CONSOLE M9
TO BANK OF PLUG AND SPACE & BUILDING GROUND

NOTES:

1. ELECTRICAL INSTALLATION TO BE IN ACCORDANCE WITH THE LATEST REVISION OF THE CANADIAN ELECTRICAL CODE, AND ONTARIO HYDRO AND ALL OTHER APPLICABLE REGULATIONS. AREAS WITHIN 3m OF UNSEALED OPENINGS OF EQUIPMENT HANDLING COAL TO BE CONSIDERED CLASS II, DIVISION 1, GROUP F HAZARDOUS LOCATIONS, AND WITHIN 3m TO 6m OF UNSEALED OPENINGS AND 3m OF SEALED (BOLTED AND GASKETTED) OPENINGS TO BE CONSIDERED CLASS II, DIVISION 2, GROUP F HAZARDOUS LOCATIONS. ELECTRICAL INSTALLATIONS WITHIN SUCH AREAS TO MEET ELECTRICAL CODE REQUIREMENTS FOR THESE DEGREES OF HAZARD.

2. RELIANCE 'MINPAK PLUS' DC DRIVES WILL BE AS FOLLOWS:
   - A. MOTOR M2 - DRIVE SAME AS 2B BELOW, EXCEPT WITH:
     - AUXILIARY MOUNTING BRACKET, MODEL 14C208.
     - AUXILIARY M CONTACT KIT, MODEL 14C219.
   - B. MOTOR M3 - STANDARD DRIVE WITH MODEL 14C11 CONTROLLER, EXCEPT WITH:
     - REMOTE OPERATOR ADAPTOR KIT, MODEL 14C320.
     - BLANK PLATE, MODEL 14C200.
     - OPERATOR'S REMOTE CONTROL STATION, MODEL 9C45, EXCEPT WITHOUT ENCLOSURE BUT WITH RUN LIGHT ADDED, MOUNTED ON CONTROL PANEL.
     - REMOTE SPEED INDICATOR, CGE TYPE 125, SCALE TO SUIT DRIVE, MOUNTED ON CONTROL PANEL.
   - C. MOTOR M8 - STANDARD DRIVE WITH MODEL 14C11 CONTROLLER, EXCEPT WITH:
     - INSTRUMENT INTERFACE KIT, MODEL 14C222, OR ALTERNATIVELY VOLTAGE/TACHOMETER-GENERATOR FOLLOWER KIT, MODEL 14C221, AS REQUIRED BY LIMESTONE WEIGHFEEDER CONTROLS.
     - LOCAL OPERATOR'S CONTROL PANEL, BASIC PANEL WITH AUTO-MANUAL SELECTOR SWITCH, 14C203.
   - D. MOTOR M11 - DRIVE SAME AS 2B ABOVE, EXCEPT WITH:
     - AUXILIARY MOUNTING BRACKET, MODEL 14C209.
     - AUXILIARY M CONTACT KIT, MODEL 14C219 EXCEPT WITH SPARE SECOND SET OF CONTACTS WIRED TO TERMINAL BLOCK.
     - FIELD SUPPLY KIT, MODEL 14C136.
   - E. MOTOR M12 - DRIVE SAME AS 2B ABOVE, EXCEPT WITH:
     - AUXILIARY MOUNTING BRACKET, MODEL 14C209.
     - AUXILIARY M CONTACT KIT, MODEL 14C219, EXCEPT WITH SPARE SECOND SET OF CONTACTS WIRED TO TERMINAL BLOCK.
     - FIELD SUPPLY KIT, MODEL 14C136.
   - F. MOTOR M13 - DRIVE SAME AS 2B ABOVE, EXCEPT WITH MODEL 14C10 CONTROLLER AND:
     - AUXILIARY MOUNTING BRACKET MODEL 14C209
     - AUXILIARY M CONTACT KIT, MODEL 14C219.
     - FIELD SUPPLY KIT, MODEL 14C136.

   DC DRIVE CONTROLLERS WILL BE SUPPLIED BY DRIVEN EQUIPMENT SUPPLIER, WHO WILL ALSO SUPPLY SEPARATE OPERATORS REMOTE CONTROL STATIONS WITH RUN LIGHT ADDED, AND REMOTE SPEED INDICATORS, FOR MOUNTING IN CONTROL PANEL BY CONTROL PANEL MANUFACTURER. MODIFICATIONS TO CONTROLLERS LISTED ABOVE WILL BE SUPPLIED BY DRIVEN EQUIPMENT SUPPLIER. ELECTRICAL INSTALLATION CONTRACTOR TO INSTALL MODIFICATIONS IN DC DRIVE CONTROLLERS, AND TO INSTALL CONTROLLERS IN DC DRIVE CONTROLLERS CABINET.

3. DC DRIVE OPERATOR'S REMOTE CONTROL STATION (OCS) INCLUDES THE FOLLOWING DEVICES:
   - SPEED ADJUSTING POTENTIOMETER.
   - RUN LIGHT, RED LED OR NEON, 24V DC, 20MA MAX (ADDITION TO STANDARD CONTROL STATION).
   - RUN-JOG SWITCH.
   - START-STOP PUSH BUTTONS.

4. MOTOR RATINGS STATED IN KW.

5. TRIP RATING OF OWNER'S 600V, 3PH. SUPPLY BREAKER TO BE 300A.

6. POWER AND CONTROL WIRING TO BE STRANDED COPPER, RW90 X-LINK INSULATED, UNLESS OTHERWISE NOTED (SEE EBP DWG #1).

7. GROUND WIRE TO BE 2/0 BARE STRANDED SOFT DRAWN OR ANNEALED COPPER, UNLESS OTHERWISE NOTED.

8. CONDUIT TO BE GALVANIZED RIGID STEEL, EXCEPT THAT IN NON-HAZARDOUS AREAS, 50 AND LARGER EMT WITH WATER-TIGHT CONNECTORS MAY BE USED. CONDUITS AND EMT TO BE RUN ON SURFACE OF BUILDING AND STRUCTURES, EXCEPT THAT WHERE THIS IS NOT SUITABLE, CONDUITS TO BE RUN ON SUPPORT RACKS AND BRACKETS CONSTRUCTED OF BURNDY 'FLEXIBAR' TYPE 4A, OR APPROVED EQUAL, CHANNEL AND FITTINGS. CONDUITS TO BE GROUPED WHERE POSSIBLE AND RUN PARALLEL TO BUILDING LINES. BOXES AND FITTINGS TO BE GALV. MALLEABLE IRON. IN CLASS I, DIVISION 2 AND NON-HAZARDOUS AREAS, BOX COVERS TO BE GASKETTED AND MAY BE OF GALVANIZED STEEL.

9. FOR ADDITIONAL NOTES SEE EBP DWG 1.

NOTES CONT'D:

10. LOCAL PUSH BUTTONS AND RED INDICATING LIGHT FOR THE FOLLOWING MOTORS TO BE AS FOLLOWS:
   - A. BUCKET ELEVATOR M7: PUSH BUTTONS (START-STOP) AND RED INDICATING LIGHT TO BE IN EEMAC TYPE 9EPG ENCLOSURE ALLEN-BRADLEY CAT. 800H-2HART, EXCEPT WITH 120V TRANSFORMER-TYPE PILOT LIGHT, OR APPROVED EQUAL. COMPLETE UNIT TO BE SUITABLE FOR CLASS II, DIVISION 1, GROUP F HAZARDOUS AREA.
   - B. LIMESTONE BLOWER M10: PUSH BUTTONS (START-STOP) AND RED INDICATING LIGHT TO BE IN EEMAC TYPE 4 ENCLOSURE ALLEN-BRADLEY CAT. 800H-2HAZA, EXCEPT WITH 120V. TRANSFORMER-TYPE PILOT LIGHT, OR APPROVED EQUAL.
   - C. LIMESTONE SEPARATOR ROTARY VALVE M17: SAME AS B ABOVE.

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Design	Drawn	Check Dwg	Check Design	Approval Design	Approval Project	Issued For	Date	Rev	Description of Revision
COW	80J	803	COW	[illegible]	GRC	MILESTONE ISSUE	10/81	0	
803	80J	803				FINAL REPORT ISSUE		A	

Reference	No	Dwg No	Reference	No	Dwg No	Reference	No	Dwg No
						BLOCK DIAGRAM, INSTRUMENTATION	3	A1-0243-6202
						SCHEMATIC DIAGRAMS	2	A1-0243-7301
						ONE LINE DIAGRAM	1	A1-0243-6101

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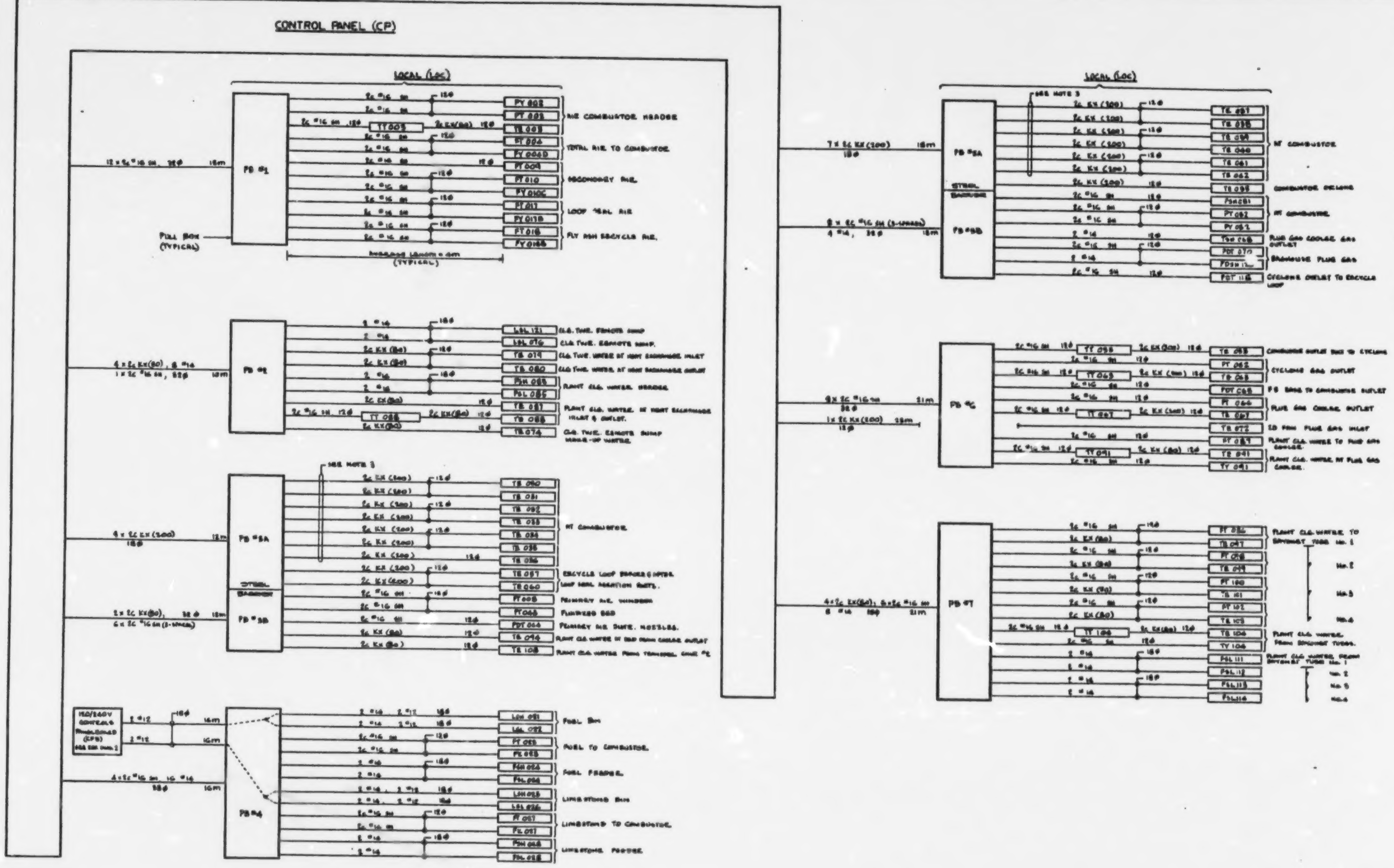
ARFBC RESEARCH FACILITY
BLOCK DIAGRAM
POWER & CONTROL

945

DRAWING NUMBER A1 0243 6201 A


CONTROL PANEL (CP)
LOCAL (LOC)
PB #1
12 × 2c #16 SH, 38φ
15m
PULL BOX (TYPICAL)
AVERAGE LENGTH = 6m (TYPICAL)
2c #16 SH
2c KX(80)
12φ
PY 002
PT 002
TT 003
TE 003
PT 004
FY 004D
PT 009
PT 010
FY 010C
PT 017
FY 017B
FT 018
FY 018B
AIR COMBUSTOR HEADER
TOTAL AIR TO COMBUSTOR
SECONDARY AIR
LOOP SEAL AIR
FLY ASH RECYCLE AIR
PB #2
4 × 2c KX(80), 8 #14
1 × 2c #16 SH, 32φ
10m
2 #14
18φ
LSL 121
LSL 076
TE 079
TE 080
PSH 085
PSL 085
TE 087
TT 088
TE 088
TE 074
CLG. TWR. REMOTE SUMP
CLG. TWR. WATER AT HEAT EXCHANGER INLET
CLG. TWR. WATER AT HEAT EXCHANGER OUTLET
PLANT CLG. WATER HEADER
PLANT CLG. WATER AT HEAT EXCHANGER INLET & OUTLET
CLG. TWR. REMOTE SUMP MAKE-UP WATER
SEE NOTE 3
PB #3A
4 × 2c KX(200)
18φ
12m
2c KX(200)
TE 030
TE 031
TE 032
TE 033
TE 034
TE 035
TE 036
TE 057
TE 060
AT COMBUSTOR
RECYCLE LOOP DOWNCOMER
LOOP SEAL AERATION PARTS
STEEL BARRIER
PB #3B
2 × 2c KX(80), 32φ
6 × 2c #16 SH (3-SPARE)
PT 008
PT 043
PDT 064
TE 094
TE 108
PRIMARY AIR WINDBOX
FLUIDIZED BED
PRIMARY AIR DISTR. NOZZLES
PLANT CLG. WATER IN BED DRAIN COOLER OUTLET
PLANT CLG. WATER FROM TRANSFER CHUTE #2
120/240V CONTROLS PANELBOARD (CPB) SEE REF. DWG. 1
2 #12
16m
4 × 2c #16 SH, 16 #14
38φ
PB #4
2 #14, 2 #12
LSH 021
LSL 022
PT 023
FE 023
FSH 024
FSL 024
LSH 025
LSL 026
PT 027
FE 027
FSH 028
FSL 028
FUEL BIN
FUEL TO COMBUSTOR
FUEL FEEDER
LIMESTONE BIN
LIMESTONE TO COMBUSTOR
LIMESTONE FEEDER
7 × 2c KX(200)
18φ
PB #5A
8 × 2c #16 SH (3-SPARES)
4 #14, 38φ
PB #5B
TE 037
TE 038
TE 039
TE 040
TE 041
TE 042
TE 095
PSHC 81
PT 082
PY 082
TSH 068
PDT 070
FDSH 112
PDT 116
AT COMBUSTOR
COMBUSTOR CYCLONE
FLUE GAS COOLER GAS OUTLET
BAGHOUSE FLUE GAS
CYCLONE OUTLET TO RECYCLE LOOP
PB #6
9 × 2c #16 SH
38φ
21m
1 × 2c KX(200)
12φ
TT 053
TE 053
PT 062
TT 063
TE 063
PDT 065
PT 066
TT 067
TE 067
TE 072
PT 089
TT 091
TE 091
TY 091
COMBUSTOR OUTLET DUCT TO CYCLONE
CYCLONE GAS OUTLET
FB BASE TO COMBUSTOR OUTLET
FLUE GAS COOLER OUTLET
ID FAN FLUE GAS INLET
PLANT CLG. WATER TO FLUE GAS COOLER
PLANT CLG. WATER AT FLUE GAS COOLER
PB #7
4 × 2c KX(80), 5 × 2c #16 SH
8 #14
18φ
21m
FT 096
TE 097
FT 098
TE 099
FT 100
TE 101
FT 102
TE 103
TT 104
TE 104
TY 104
FSL 111
FSL 112
FSL 113
FSL 114
PLANT CLG. WATER TO BAYONET TUBE No. 1
No. 2
No. 3
No. 4
PLANT CLG. WATER FROM BAYONET TUBES
PLANT CLG. WATER FROM BAYONET TUBE No. 1

NOTES:

1. INSTRUMENTATION CABLES TO BE AS FOLLOWS:
   - A. ELECTRONIC INSTRUMENT CABLES:
     - 2C #16 SH - 1 PAIR, 16 AWG, 150V, PVC INSULATION, TWISTED AND SHIELDED, WITH PVC JACKET, SHAWFLEX 'DEKORON' TYPE 1882, OR APPROVED EQUAL.
     - 3C #16 SH - SAME AS 2C #16 SH ABOVE, EXCEPT 1 TRIAD, TYPE 1862, OR APPROVED EQUAL.
   - B. THERMOCOUPLE EXTENSION WIRE:
     - 2C KX(80) - 1 PAIR, 16 AWG, ANSI TYPE KX, 105°C PVC INSULATION, TWISTED AND SHIELDED, 80°C PVC JACKET, SHAWFLEX 'DEKORON' CMX PART 1802-636, OR APPROVED EQUAL.
     - 2C KX(200) - SAME AS 2C KX(80), EXCEPT WITH 200°C TEFLON FEP INSULATION AND JACKET, SHAWFLEX PART 12092-0202, OR APPROVED EQUAL.
2. PULL BOXES NOT INSTALLED IN HAZARDOUS AREAS TO BE OF FORMED GALVANIZED STEEL WITH WELDED SEAMS AND GASKETTED COVERS, CSA ENCLOSURE 5 (DUST TIGHT).
3. SIGNALS FROM 3 OF THERMOCOUPLES TE 030 TO 042 INCLUSIVE, WILL EACH BE TRANSMITTED VIA 2C KX(200) EXTENSION WIRE TO A SEPARATE TEMPERATURE TRANSMITTER, AND THEN VIA 2C #16 SH INSTRUMENT CABLE FROM THE TRANSMITTER THROUGH PULL BOX #3B OR #5B, TO THE CONTROL PANEL (IE SIMILARLY TO TE AND TT 053, 063, 067 AND 091). THE 3 THERMOCOUPLES MENTIONED ABOVE WILL BE SELECTED AT SITE AND 3 SPARE 2C #16 SH CABLES SHALL BE INSTALLED BETWEEN THE CONTROL PANEL AND EACH OF PULL BOXES #3B AND #5B FOR THE DESCRIBED ABOVE. LEAVE SUFFICIENT LENGTH OF SPARE 2C #16 SH CABLES COILED IN PULL BOXES TO REACH 3 TRANSMITTERS. LEAVE CORRESPONDING 3 REDUNDANT 2C KX(200) EXTENSION WIRES INSTALLED IN CONDUITS BETWEEN PULL BOXES #3A AND #5A, AND CONTROL PANEL.
4. PENDING DETERMINATION OF LOCATION OF CONTROL AND ELECTRICAL ROOM(S), LENGTHS OF WIRES, CABLE AND CONDUIT RUNS INCLUDE FROM LOCAL OR FIELD DEVICES TO INTERSECTION OF BAYLINES H AND 15A.
5. FOR ADDITIONAL NOTES SEE REF. DWG 1.

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947

946

Design	Drawn	Check Dwg	Check Design	Approval Design	Approval Project	Issued For	Date	Rev	Description of Revision
GEF	RG4	GEF	GOW		GRL	MILESTONE ISSUE		0	
GEF	MJ	GEF				FINAL REPORT ISSUE		A	

REFERENCE	No.	DWG No.
LOOP DIAGRAMS	3	3-0243-6301-001 TO 300 INCLUSIVE
ONE LINE DIAGRAM	2	A1-0243-6101
BLOCK DIAGRAM - POWER & CONTROL	1	A1-0243-6201

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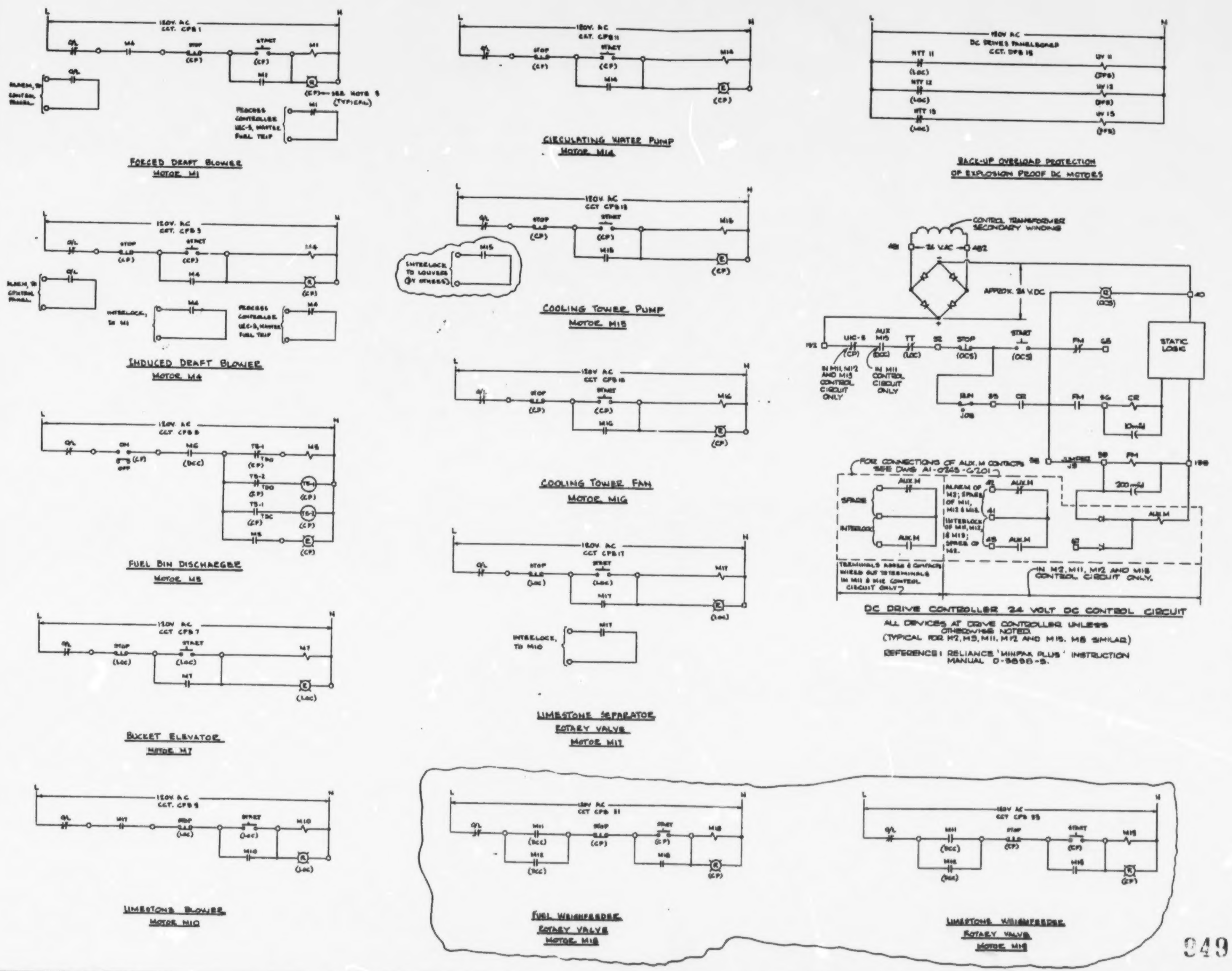
BLOCK DIAGRAM
INSTRUMENTATION

DRAWING NUMBER A1 0243 6202 A


FORCED DRAFT BLOWER
MOTOR M1
120V. AC CCT. CPB 1
INDUCED DRAFT BLOWER
MOTOR M4
120V. AC CCT. CPB 3
FUEL BIN DISCHARGER
MOTOR M5
120V. AC CCT CPB 5
BUCKET ELEVATOR
MOTOR M7
120V. AC CCT CPB 7
LIMESTONE BLOWER
MOTOR M10
120V. AC CCT. CPB 9
CIRCULATING WATER PUMP
MOTOR M14
120V. AC CCT. CPB 11
COOLING TOWER PUMP
MOTOR M15
120V. AC CCT CPB 15
INTERLOCK TO LOUVERS (BY OTHERS)
COOLING TOWER FAN
MOTOR M16
120V. AC CCT CPB 16
LIMESTONE SEPARATOR
ROTARY VALVE
MOTOR M17
120V. AC CCT CPB 17
INTERLOCK, TO M10
FUEL WEIGHFEEDER
ROTARY VALVE
MOTOR M18
120V. AC CCT CPB 31
LIMESTONE WEIGHFEEDER
ROTARY VALVE
MOTOR M19
120V. AC CCT CPB 33
ALARM, TO CONTROL PANEL
PROCESS CONTROLLER UIC-5, MASTER FUEL TRIP
SEE NOTE 3 (TYPICAL)
BACK-UP OVERLOAD PROTECTION
OF EXPLOSION PROOF DC MOTORS
120V AC DC DRIVES PANELBOARD CCT. DPB 15
CONTROL TRANSFORMER SECONDARY WINDING
24 V.AC
APPROX. 24 V.DC
STATIC LOGIC
IN M11, M12 AND M15 CONTROL CIRCUIT ONLY
IN M11 CONTROL CIRCUIT ONLY
FOR CONNECTIONS OF AUX. M CONTACTS SEE DWG A1-0243-G201
SPARE
INTERLOCK
ALARM OF M2; SPARE OF M11, M12 & M15.
INTERLOCK OF M11, M12, & M15; SPARE OF M2.
TERMINALS 42&43 & CONTACTS WIRED OUT TO TERMINALS IN M11 & M12 CONTROL CIRCUIT ONLY
IN M2, M11, M12 AND M15 CONTROL CIRCUIT ONLY.
DC DRIVE CONTROLLER 24 VOLT DC CONTROL CIRCUIT
ALL DEVICES AT DRIVE CONTROLLER UNLESS OTHERWISE NOTED.
(TYPICAL FOR M2, M3, M11, M12 AND M15. M8 SIMILAR)
REFERENCE: RELIANCE 'MINPAK PLUS' INSTRUCTION MANUAL D-3856-5.

LEGEND:

- Ⓡ - RED INDICATING LIGHT.
- Ⓣ1Ⓣ - REPEAT CYCLE TIMER
- AUX.M - AUXILIARY RELAY TO ARMATURE LOOP CONTACTOR } IN DC DRIVE CONTROLLER
- CR - CONTROL RELAY } IN DC DRIVE CONTROLLER
- FM - ARMATURE LOOP CONTACTOR } IN DC DRIVE CONTROLLER
- HTT - HIGH SET THERMOSTAT IN EXPLOSION-PROOF DC MOTOR.
- TT - THERMOSTAT (LOW SET IN EXPLOSION-PROOF DC MOTORS)
- UIC-5 - PROCESS CONTROLLER UIC-5, MASTER FUEL TRIP.
- UV - UNDERVOLTAGE TRIP COIL IN DC DRIVE FEEDER BREAKER.
- ☐ - TERMINAL IN DC DRIVE CONTROLLER
- ○ - TERMINAL IN MCC.

NOTES:

1. ALL DEVICES AT MOTOR CONTROL CENTER (MCC) UNLESS OTHERWISE NOTED (SEE DC DRIVE CONTROLLER 24V DC CONTROL CIRCUIT).
2. ALL 120V POWER SUPPLIES SHOWN ARE FROM 120/240V CONTROLS PANELBOARD UNLESS OTHERWISE NOTED. SEE REF DWG #1.
3. ABBREVIATIONS SHOWN IN ( ) DENOTE LOCATION OF ELECTRICAL DEVICES AS FOLLOWS:
   - (CP) - CONTROL PANEL.
   - (DCC) - DC DRIVE CONTROLLER CABINET.
   - (DPB) - DC DRIVES PANELBOARD.
   - (LOC) - LOCAL.
   - (OCS) - OPERATOR'S CONTROL STATION.

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SCHEMATIC DIAGRAMS

Design	Drawn	Check Dwg	Check Design	Approval Division	Approval Project	Issued For	Date	Rev	Description of Revision
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	GRC	MILESTONE ISSUE	[illegible]	0	
[illegible]	[illegible]	[illegible]				FINAL REPORT ISSUE		A	

REFERENCE	No.	Dwg No.
BLOCK DIAGRAM POWER & CONTROL	2	A1-0243-6201
ONE LINE DIAGRAM	1	A1-0243-6101

DRAWING NUMBER A1 0243 7301 A

SERVICE OR FUNCTION	MOTOR NO. P.O. NO.	KW RPM AMPS	VOLTAGE FRAME TEMP. RISE	ENCLOSURE MFR. MODEL	REMARKS	POWER SOURCE
FORCED DRAFT BLOWER	M1	45	575V. AC	TE		MCC
BED DRAIN COOLER	M2	0.75 VARIABLE	180V. DC	TE	PERMANENT MAGNET FIELD	DPB
BAGHOUSE ROTARY VALVE	M3	0.38 VARIABLE	180V. DC	TE	PERMANENT MAGNET FIELD.	DPB
INDUCED DRAFT BLOWER	M4	11.25	575V AC	TE		MCC
FUEL BIN DISCHARGER	M5	2.25	575V. AC	EP		MCC
FUEL WEIGHFEEDER	M6	0.19 VARIABLE	125V. DC HOLD ?	EP		DPB
BUCKET ELEVATOR	M7	0.75	575V. AC	EP		MCC
LIMESTONE BIN SCREW PREFEEDER	M8	0.38 VARIABLE	180V. DC	TE	PERMANENT MAGNET FIELD	DPB
LIMESTONE WEIGHFEEDER	M9	0.19 VARIABLE	125V. DC HOLD ?	TE		DPB
LIMESTONE BLOWER	M10	3.75	575V. AC	TE		MCC
TRANSFER CONVEYOR NO.1	M11	0.75 VARIABLE	180 V. DC	EP	DC FIELD	DPB
TRANSFER CONVEYOR NO.2	M12	1.13 VARIABLE	180 V. DC	EP	DC FIELD	DPB

NOTES: 1. EXPLOSION PROOF (EP) MOTORS TO BE APPROVED FOR CLASS II, DIVISION 1, GROUP F HAZARDOUS LOCATION.

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REF DWG.

DESIGN	DRAWN	CHECK DWG	CHECK DESIGN	APPROVAL [illegible]	APPROVAL [illegible]	ISSUED FOR	DATE	REV
RCJ	RCJ	RCJ	CDW	JMJ	GPC	MILESTONE ISSUE	DEC 16/83	O
RCJ	RCJ	RCS				FINAL REPORT ISSUE		A

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MOTOR LIST SH. 1 OF 2

A	0243		7601	A

SERVICE OR FUNCTION	MOTOR NO. P.O. No.	KW RPM AMPS	VOLTAGE FRAME TEMP. RISE	ENCLOSURE MFR MODEL	REMARKS	POWER SOURCE
FEED CHUTE ROTARY VALVE	M13	0.38 VARIABLE	90 V. DC	EP	DC FIELD	DPB
CIRCULATING WATER PUMP	M14	11.25	575V. AC	TE		MCC
COOLING TOWER PUMP	M15	7.5	575V. AC	TE		MCC
COOLING TOWER FAN	M16	22.5	575V AC	TE		MCC
LIMESTONE SEPARATOR ROTARY VALVE	M17	0.38	575V AC	TE		MCC
FUEL WEIGHFEEDER ROTARY VALVE	M18	0.75	575V AC	EP		MCC
LIMESTONE WEIGHFEEDER ROTARY VALVE	M19	0.75	575V AC	EP		MCC

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS"

REF DWG.

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DESIGN	DRAWN	CHECK DWG	CHECK DESIGN	APPROVAL DIVISION	APPROVAL PROJECT	ISSUED FOR	DATE	REV
RCJ	RCJ	RCT	CSW		GRL	MILESTONE ISSUE	DEC 16/83	0
RCJ	RCJ	RJ				FINAL REPORT ISSUE		A

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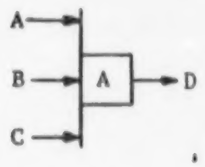
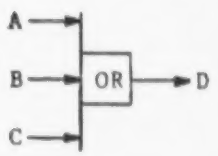
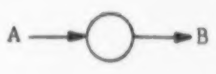
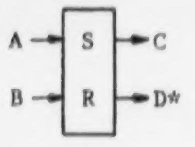
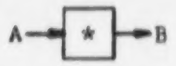
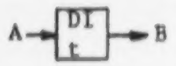
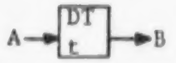
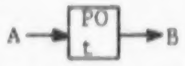
MOTOR LIST			SH. 2 OF 2		
A	0243		7602	A	

INSTRUMENTATION

Instrumentation

FUNCTION	SYMBOL	DEFINITION
INPUT	STATEMENT OF INPUT →	AN INPUT TO THE LOGIC SEQUENCE
OUTPUT	→ STATEMENT OF OUTPUT	AN OUTPUT FROM THE LOGIC SEQUENCE
AND		LOGIC OUTPUT D EXISTS IF AND ONLY IF ALL LOGIC INPUTS A, B AND C EXIST
OR		LOGIC OUTPUT D EXISTS IF AND ONLY IF ONE OR MORE OF LOGIC INPUTS A, B AND C EXIST
NOT		LOGIC OUTPUT B EXISTS IF AND ONLY IF LOGIC INPUT A DOES NOT EXIST

FUNCTION	SYMBOL	DEFINITION
MEMORY	 * OUTPUT D SHALL NOT BE SHOWN IF IT IS NOT USED.	S REPRESENTS SET MEMORY AND R REPRESENTS RESET MEMORY LOGIC OUTPUT C EXISTS AS SOON AS LOGIC INPUT A EXISTS. C CONTINUES TO EXIST, REGARDLESS OF THE SUBSEQUENT STATE OF A UNTIL THE MEMORY IS RESET, i.e., TERMINATED BY LOGIC INPUT B EXISTING. C REMAINS TERMINATED REGARDLESS OF THE SUBSEQUENT STATE OF B, UNTIL A CAUSES THE MEMORY TO BE SET. LOGIC OUTPUT D, IF USED, EXISTS WHEN C DOES NOT EXIST, AND D DOES NOT EXIST WHEN C EXISTS INPUT-OVERRIDE OPTION IF INPUTS A AND B EXIST SIMULTANEOUSLY, AND IF IT IS DESIRED TO HAVE A OVERRIDE B, THEN S SHOULD BE ENCIRCLED i.e.Ⓢ IF B IS TO OVERRIDE A THEN R SHOULD BE ENCIRCLED i.e.Ⓡ

FUNCTION	SYMBOL	DEFINITION
TIME ELEMENT		LOGIC OUTPUT B EXISTS WITH A TIME RELATIONSHIP TO LOGIC INPUT A AS SPECIFIED.
	 DELAY INITIATION OF OUTPUT	THE CONTINUOUS EXISTENCE OF LOGIC INPUT A FOR TIME t CAUSES LOGIC OUTPUT B TO EXIST WHEN t EXPIRES. B TERMINATES WHEN A TERMINATES.
	 DELAY TERMINATION OF OUTPUT	THE EXISTENCE OF LOGIC INPUT A CAUSES LOGIC OUTPUT B TO EXIST IMMEDIATELY. B TERMINATES WHEN A HAS TERMINATED AND HAS NOT AGAIN EXISTED FOR TIME t
	 PULSE OUTPUT	THE EXISTENCE OF LOGIC INPUT A, REGARDLESS OF ITS SUBSEQUENT STATE, CAUSES LOGIC OUTPUT B TO EXIST IMMEDIATELY. B EXISTS FOR TIME t AND THEN TERMINATES.

Design	Drawn	Check	Appd	Issued for	Date	Rev

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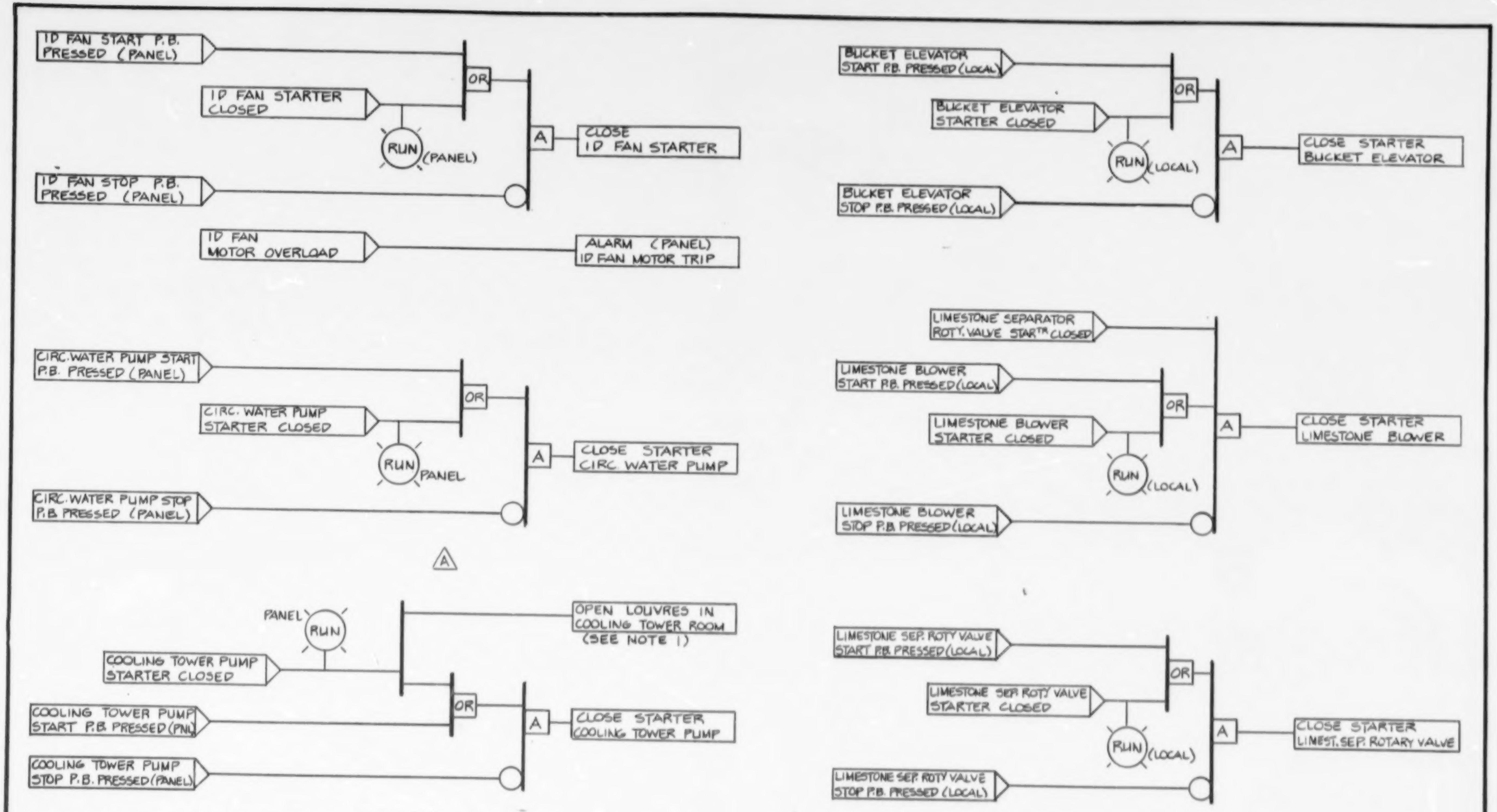
LOGIC DIAGRAM
SYMBOLS AND DEFINITIONS

B 0243 8101


ID FAN START P.B. PRESSED (PANEL)
ID FAN STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE ID FAN STARTER
ID FAN STOP P.B. PRESSED (PANEL)
ID FAN MOTOR OVERLOAD
ALARM (PANEL) ID FAN MOTOR TRIP
BUCKET ELEVATOR START P.B. PRESSED (LOCAL)
BUCKET ELEVATOR STARTER CLOSED
OR
RUN
(LOCAL)
A
CLOSE STARTER BUCKET ELEVATOR
BUCKET ELEVATOR STOP P.B. PRESSED (LOCAL)
CIRC. WATER PUMP START P.B. PRESSED (PANEL)
CIRC. WATER PUMP STARTER CLOSED
OR
RUN
PANEL
A
CLOSE STARTER CIRC WATER PUMP
CIRC. WATER PUMP STOP P.B PRESSED (PANEL)
LIMESTONE SEPARATOR ROTY. VALVE STARTR CLOSED
LIMESTONE BLOWER START P.B. PRESSED (LOCAL)
LIMESTONE BLOWER STARTER CLOSED
OR
RUN
(LOCAL)
A
CLOSE STARTER LIMESTONE BLOWER
LIMESTONE BLOWER STOP P.B PRESSED (LOCAL)
A
PANEL
RUN
OPEN LOUVRES IN COOLING TOWER ROOM (SEE NOTE 1)
COOLING TOWER PUMP STARTER CLOSED
OR
COOLING TOWER PUMP START P.B PRESSED (PNL)
A
CLOSE STARTER COOLING TOWER PUMP
COOLING TOWER PUMP STOP P.B. PRESSED (PANEL)
LIMESTONE SEP. ROTY VALVE START P.B. PRESSED (LOCAL)
LIMESTONE SEP. ROTY VALVE STARTER CLOSED
OR
RUN
(LOCAL)
A
CLOSE STARTER LIMEST. SEP. ROTARY VALVE
LIMESTONE SEP. ROTY VALVE STOP P.B. PRESSED (LOCAL)

NOTE 1. LOUVRE CONTROLS ARE NOT INCLUDED IN SCOPE OF WORK. COOLING TOWER PUMP STARTER AUXILIARY CONTACTS ONLY, ARE PROVIDED FOR.

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Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF	GRC	GRC	MILESTONE ISSUE	DEC 1/83	0
AF	AF			FINAL REPORT ISSUE		A

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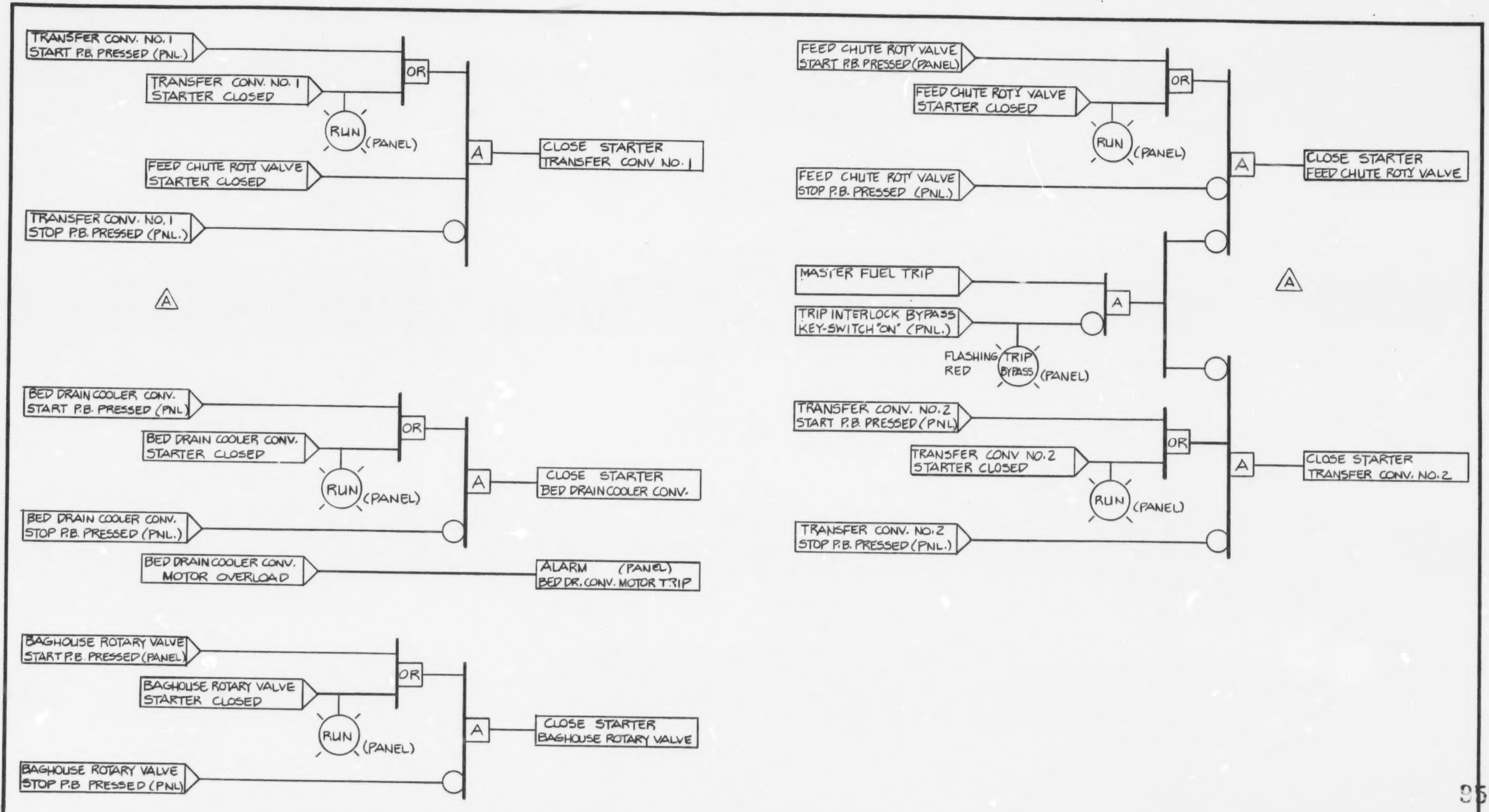
LOGIC DIAGRAM
I.D. FAN, CIRC. WATER PUMP, COOLING TOWER PUMP, BUCKET ELEV., LIMEST. SEP. ROTY VALVE, LIMESTONE BLOWER

B 0243 8102 A


TRANSFER CONV. NO. 1 START P.B. PRESSED (PNL.)
TRANSFER CONV. NO. 1 STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE STARTER TRANSFER CONV NO. 1
FEED CHUTE ROTY VALVE STARTER CLOSED
TRANSFER CONV. NO. 1 STOP P.B. PRESSED (PNL.)
A
BED DRAIN COOLER CONV. START P.B. PRESSED (PNL)
BED DRAIN COOLER CONV. STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE STARTER BED DRAIN COOLER CONV.
BED DRAIN COOLER CONV. STOP P.B. PRESSED (PNL.)
BED DRAIN COOLER CONV. MOTOR OVERLOAD
ALARM (PANEL) BED DR. CONV. MOTOR TRIP
BAGHOUSE ROTARY VALVE START P.B. PRESSED (PANEL)
BAGHOUSE ROTARY VALVE STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE STARTER BAGHOUSE ROTARY VALVE
BAGHOUSE ROTARY VALVE STOP P.B PRESSED (PNL)
FEED CHUTE ROTY VALVE START P.B. PRESSED (PANEL)
FEED CHUTE ROTY VALVE STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE STARTER FEED CHUTE ROTY VALVE
FEED CHUTE ROTY VALVE STOP P.B. PRESSED (PNL.)
A
MASTER FUEL TRIP
A
TRIP INTERLOCK BYPASS KEY-SWITCH "ON" (PNL.)
FLASHING RED
TRIP BYPASS
(PANEL)
TRANSFER CONV. NO. 2 START P.B. PRESSED (PNL)
TRANSFER CONV NO. 2 STARTER CLOSED
OR
RUN
(PANEL)
A
CLOSE STARTER TRANSFER CONV. NO. 2
TRANSFER CONV. NO. 2 STOP P.B. PRESSED (PNL.)

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Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF	GRC	GRC	MILESTONE ISSUE	DEC 16/85	0
AF	AF			FINAL REPORT ISSUE		A

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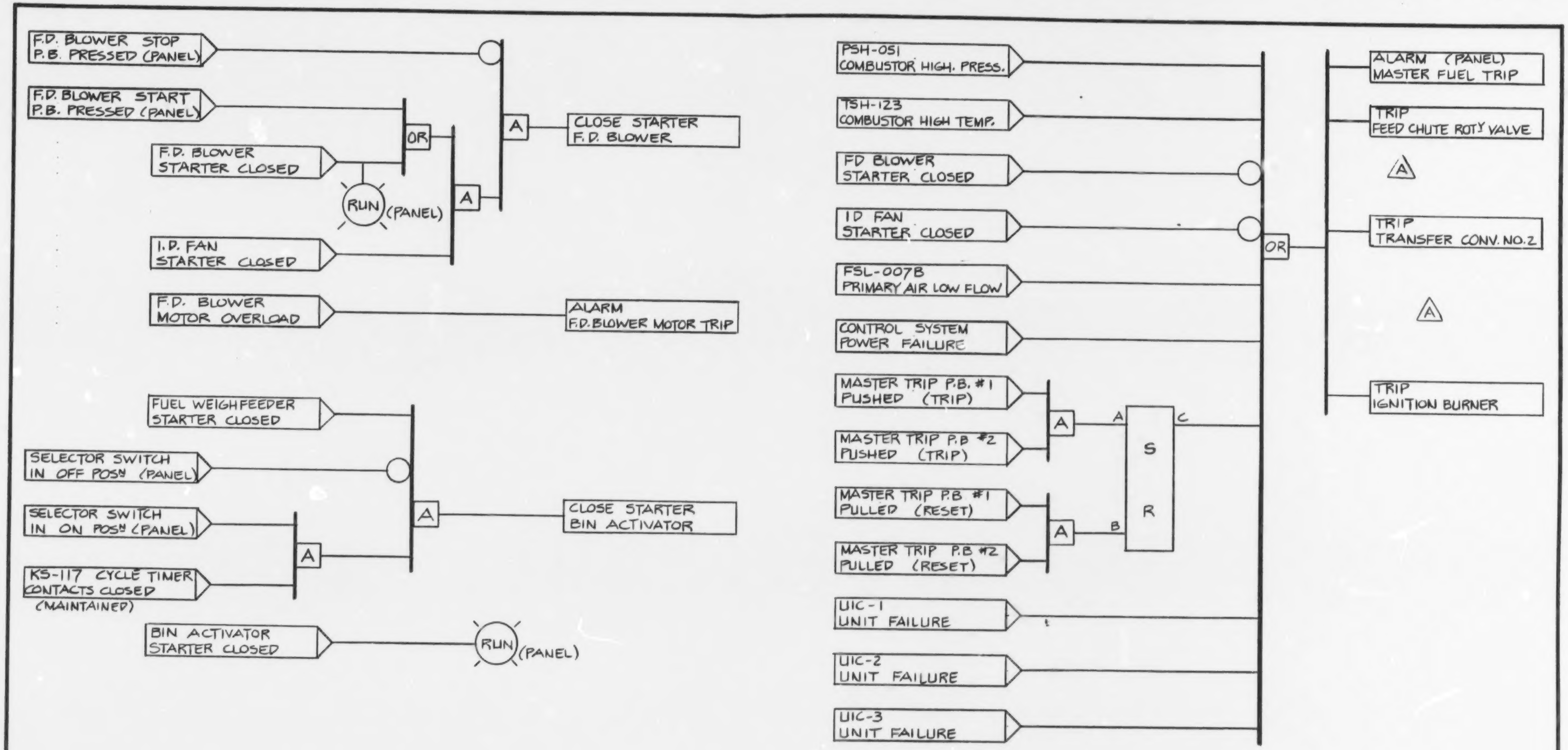
LOGIC DIAGRAM

TRANSFER CONV. NO. 1 & 2 / FEED CHUTE ROTARY VALVE
BED DRAIN COOLER CONV. / BAGHOUSE ROTARY VALVE

B	0243		8103	A


F.D. BLOWER STOP
P.B. PRESSED (PANEL)
F.D. BLOWER START
P.B. PRESSED (PANEL)
OR
F.D. BLOWER
STARTER CLOSED
RUN (PANEL)
A
A
CLOSE STARTER
F.D. BLOWER
I.D. FAN
STARTER CLOSED
F.D. BLOWER
MOTOR OVERLOAD
ALARM
F.D. BLOWER MOTOR TRIP
FUEL WEIGHFEEDER
STARTER CLOSED
SELECTOR SWITCH
IN OFF POSN (PANEL)
SELECTOR SWITCH
IN ON POSN (PANEL)
A
A
CLOSE STARTER
BIN ACTIVATOR
KS-117 CYCLE TIMER
CONTACTS CLOSED
(MAINTAINED)
BIN ACTIVATOR
STARTER CLOSED
RUN (PANEL)
PSH-051
COMBUSTOR HIGH PRESS.
TSH-123
COMBUSTOR HIGH TEMP.
FD BLOWER
STARTER CLOSED
ID FAN
STARTER CLOSED
FSL-007B
PRIMARY AIR LOW FLOW
CONTROL SYSTEM
POWER FAILURE
MASTER TRIP P.B. #1
PUSHED (TRIP)
MASTER TRIP P.B #2
PUSHED (TRIP)
MASTER TRIP P.B #1
PULLED (RESET)
MASTER TRIP P.B #2
PULLED (RESET)
A
A
A
B
S
R
C
UIC-1
UNIT FAILURE
UIC-2
UNIT FAILURE
UIC-3
UNIT FAILURE
OR
ALARM (PANEL)
MASTER FUEL TRIP
TRIP
FEED CHUTE ROTY VALVE
A
TRIP
TRANSFER CONV. NO. 2
A
TRIP
IGNITION BURNER

NOTE: MASTER FUEL TRIP LOGIC TO BE IMPLEMENTED ON UIC-3

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AF	AF	GRC	GRC	MILESTONE ISSUE	DEC 6/85	0
AF	AF			FINAL REPORT ISSUE		A

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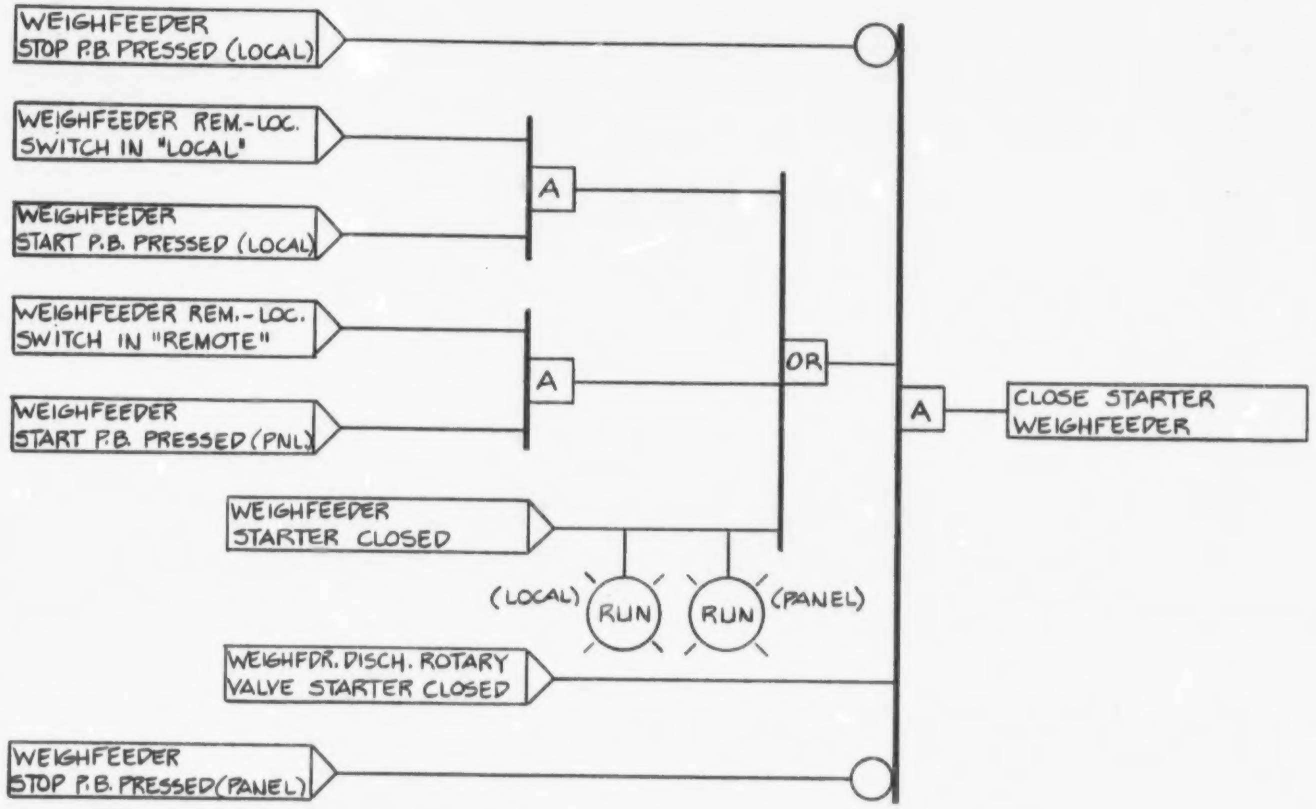
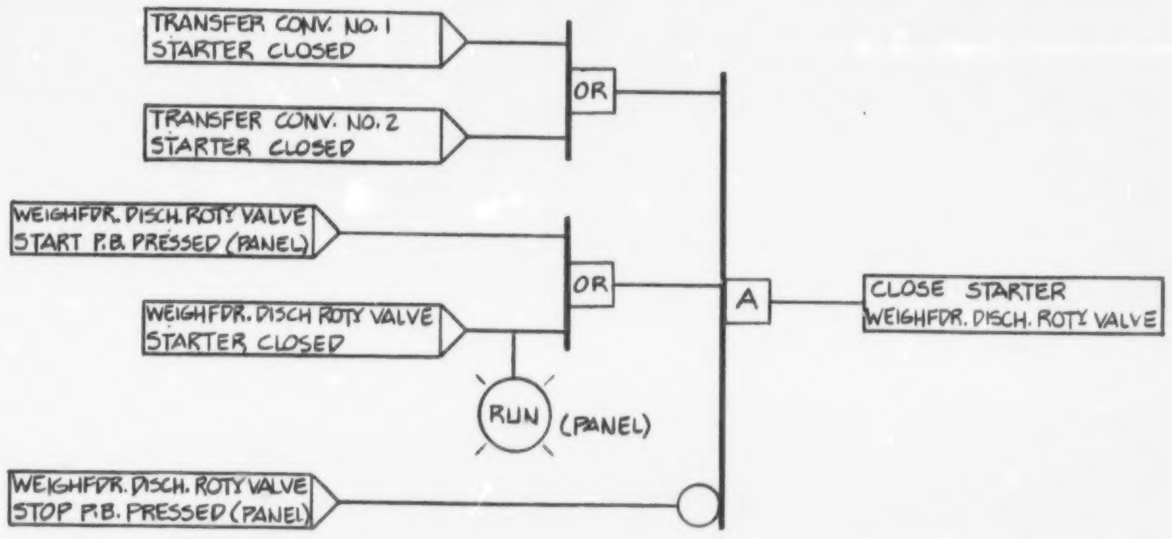
LOGIC DIAGRAM
F.D. BLOWER / FUEL BIN ACTIVATOR
MASTER TRIP

B	0243		8104	A


WEIGHFEEDER STOP P.B. PRESSED (LOCAL)
WEIGHFEEDER REM.-LOC. SWITCH IN "LOCAL"
WEIGHFEEDER START P.B. PRESSED (LOCAL)
WEIGHFEEDER REM.-LOC. SWITCH IN "REMOTE"
WEIGHFEEDER START P.B. PRESSED (PNL)
A
A
OR
A
CLOSE STARTER WEIGHFEEDER
WEIGHFEEDER STARTER CLOSED
(LOCAL)
RUN
RUN
(PANEL)
WEIGHFDR. DISCH. ROTARY VALVE STARTER CLOSED
WEIGHFEEDER STOP P.B. PRESSED (PANEL)

APPLIES TO LIMESTONE AND FUEL WEIGHFEEDERS


TRANSFER CONV. NO. 1 STARTER CLOSED
TRANSFER CONV. NO. 2 STARTER CLOSED
OR
WEIGHFDR. DISCH. ROTY VALVE START P.B. PRESSED (PANEL)
WEIGHFDR. DISCH ROTY VALVE STARTER CLOSED
OR
A
CLOSE STARTER WEIGHFDR. DISCH. ROTY VALVE
RUN
(PANEL)
WEIGHFDR. DISCH. ROTY VALVE STOP P.B. PRESSED (PANEL)

APPLIES TO ROTARY VALVES ON DISCHARGE OF LIMESTONE AND FUEL WEIGHFEEDERS

NOTES:

1. WHEN WEIGHFEEDER REMOTE-LOCAL SWITCH IS IN "LOCAL", SPEED SETPOINT IS ENTERED LOCALLY AT WEIGHFEEDER; WHEN IN "REMOTE", SPEED SETPOINT IS GENERATED IN ANALOG CONTROLS.
2. LIMESTONE BIN DISCHARGE ROTARY VALVE IS SLAVED TO LIMESTONE FEEDER.

** PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS.

Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF			FINAL REPORT ISSUE		0

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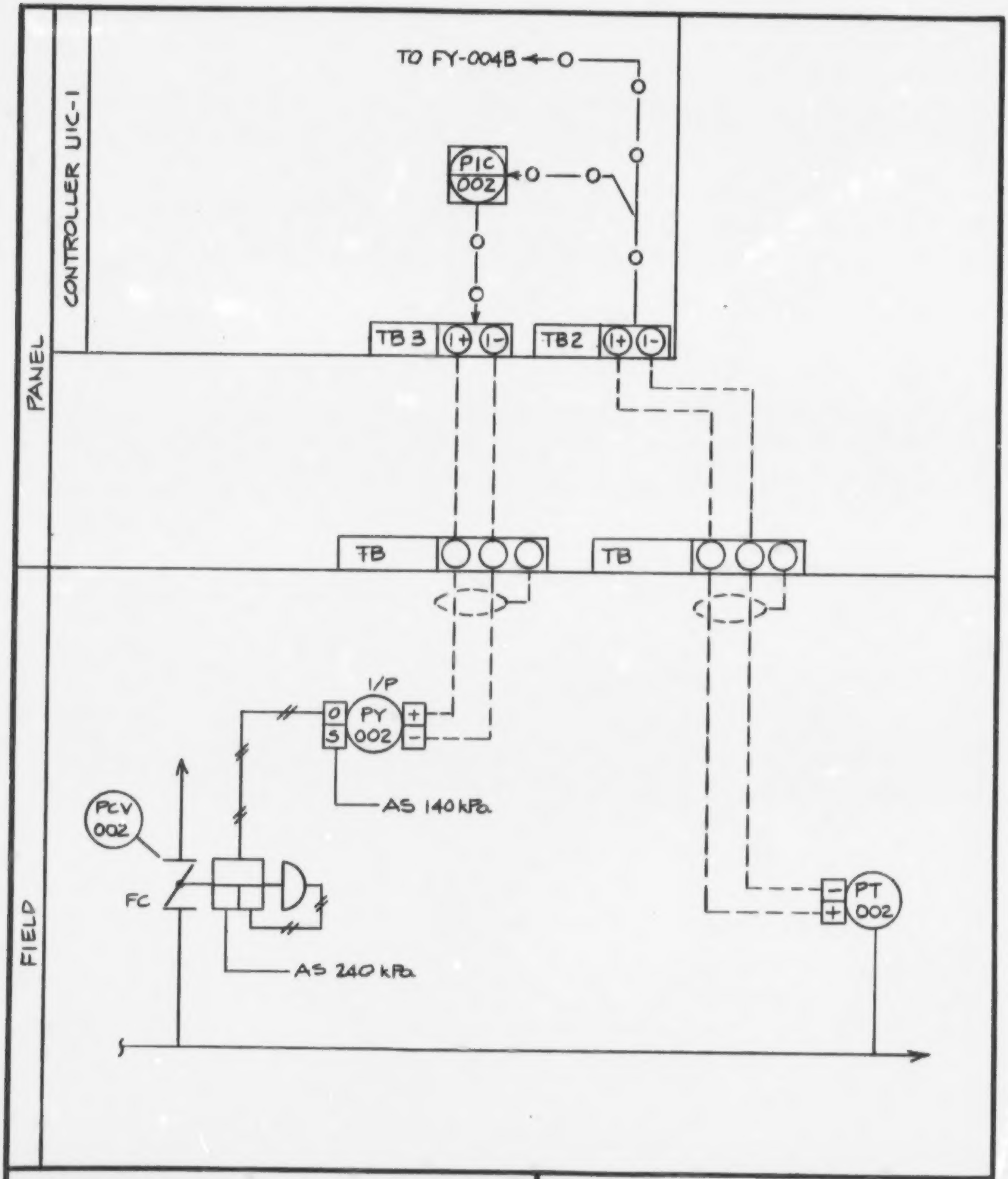
LOGIC DIAGRAM

WEIGHFEEDERS AND WEIGHFEEDER DISCHARGE ROTARY VALVES.

B	0243		8105	0


TO FY-004B
CONTROLLER UIC-1
PIC
002
PANEL
TB 3
1+
1-
TB2
1+
1-
TB
TB
FIELD
1/P
PY
002
O
S
+
-
AS 140 kPa
PCV
002
FC
AS 240 kPa
PT
002
-
+

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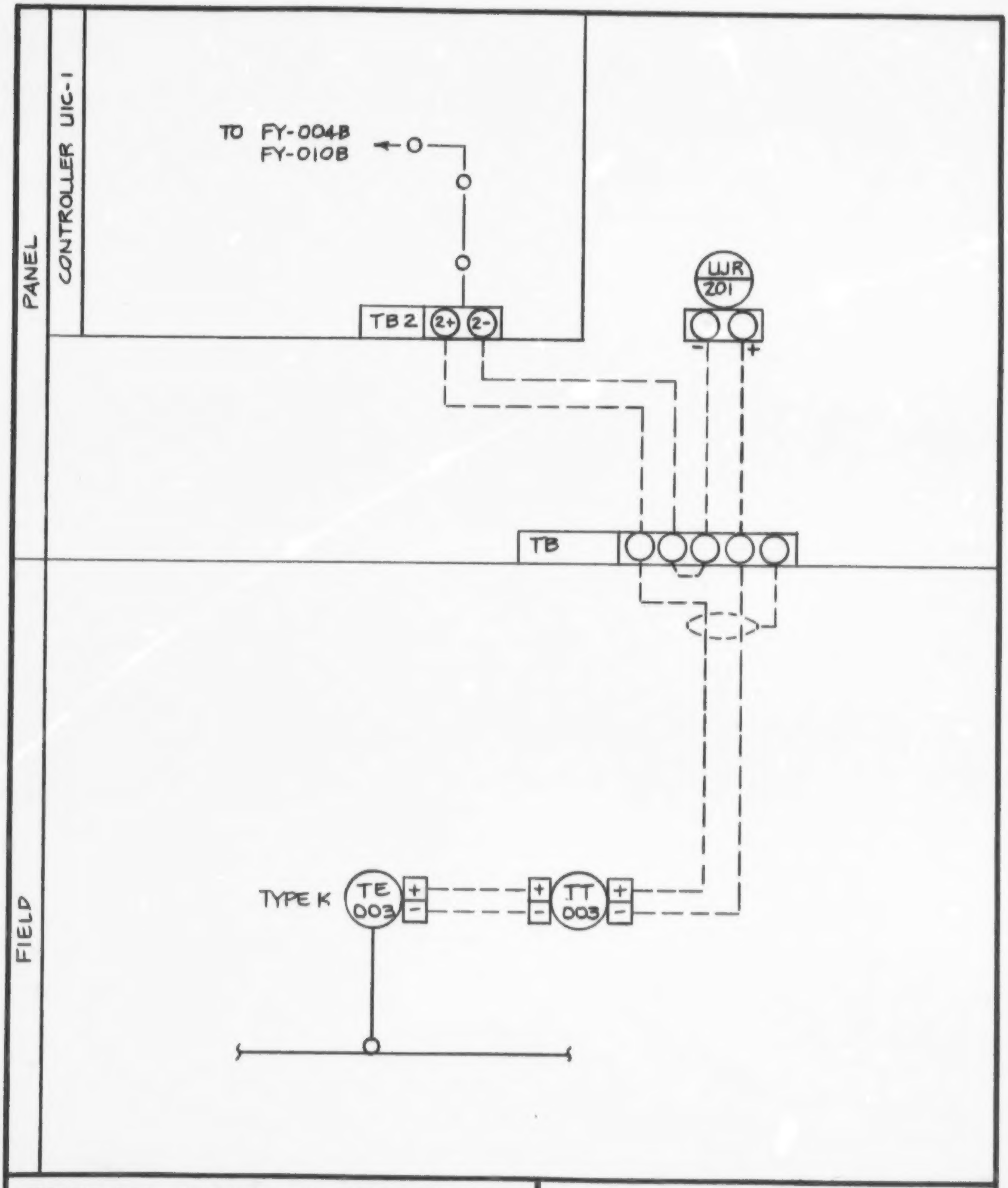
DWN	CHK	APP	DATE	RV
AF				0

COMBUSTION AIR HEADER
- PRESSURE

LOOP DIAGRAM

A	**0243**	8301	002	0


PANEL
CONTROLLER UIC-1
TO FY-004B
FY-010B
TB2
2+
2-
UJR
201
-
+
TB
FIELD
TYPE K
TE
003
+
-
+
-
TT
003
+
-

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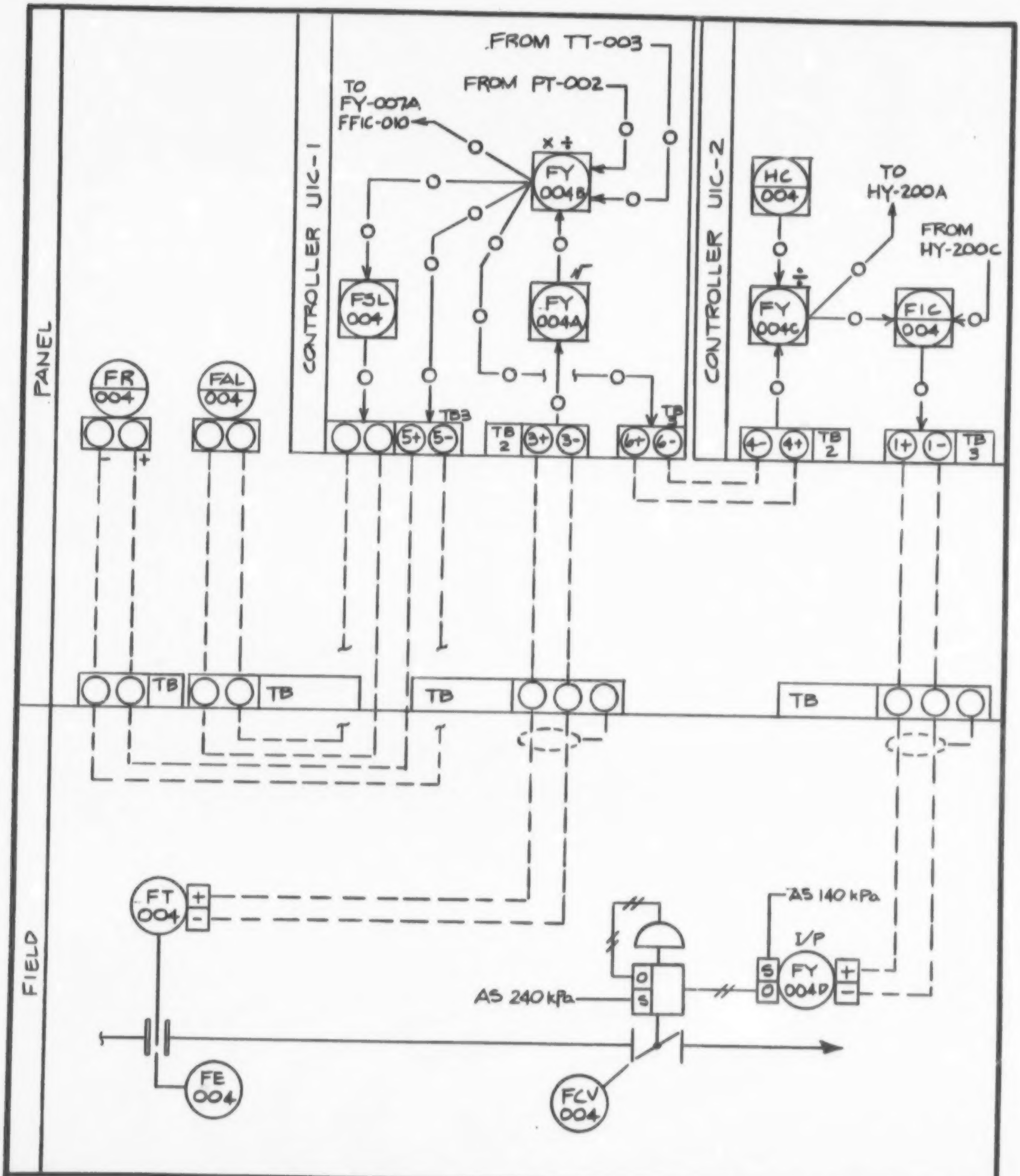
AF				0

COMBUSTION AIR HEADER
- TEMPERATURE

LOOP DIAGRAM

A	0243	8301	003	0


FROM TT-003
FROM PT-002
TO FY-007A FFIC-010
× ÷
FY 004B
CONTROLLER UIC-1
FSL 004
FY 004A
TB3
5+
5-
TB 2
3+
3-
TB 3
6+
6-
CONTROLLER UIC-2
HC 004
TO HY-200A
FROM HY-200C
÷
FY 004C
FIC 004
4-
4+
TB 2
1+
1-
TB 3
PANEL
FR 004
FAL 004
-
+
TB
TB
TB
TB
FIELD
FT 004
+
-
AS 140 kPa
I/P
S
O
FY 004D
+
-
O
S
AS 240 kPa
FE 004
FCV 004

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DWN	CHK	APP	DATE	RV
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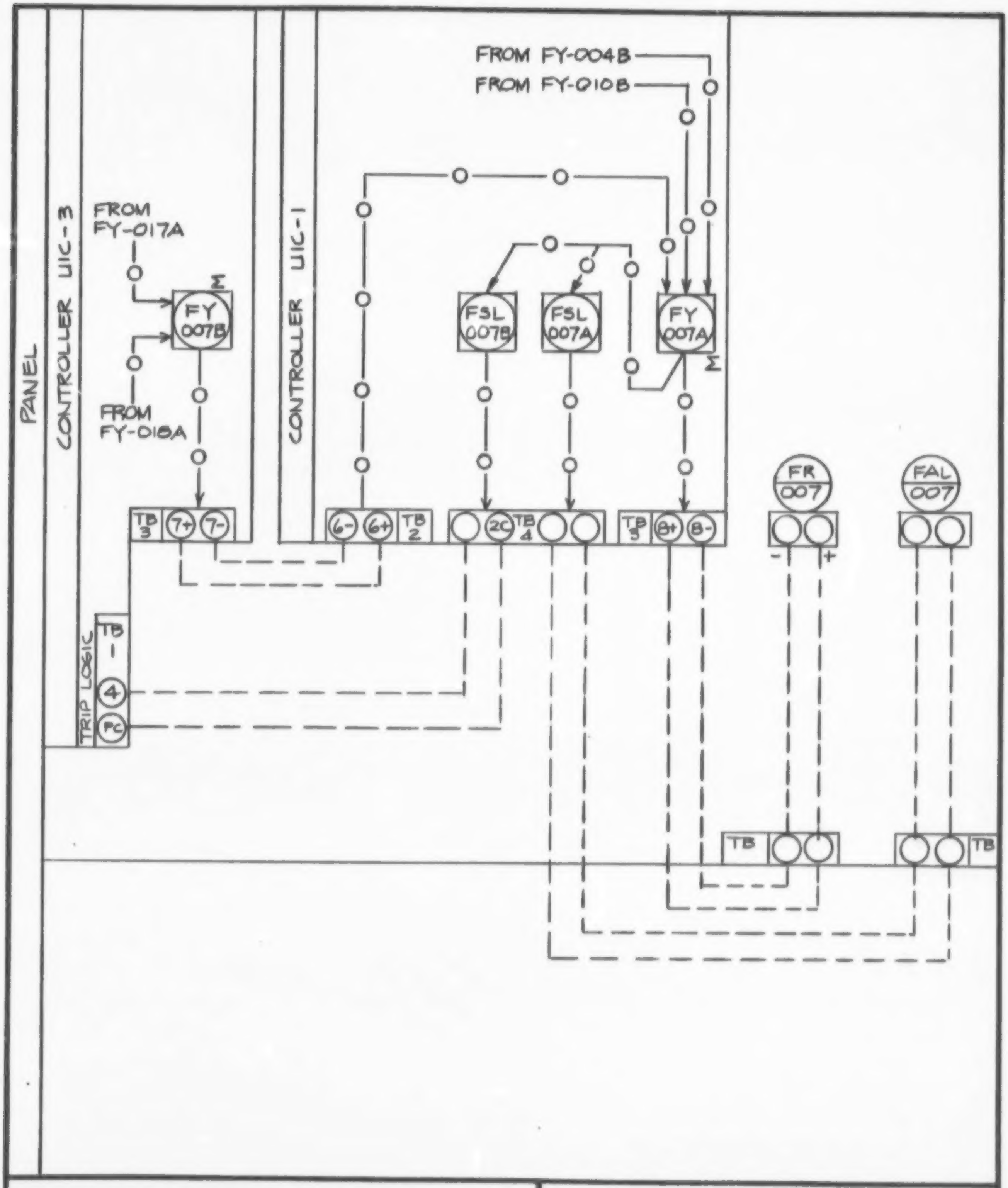
TOTAL AIR TO COMBUSTOR - FLOW

968

LOOP DIAGRAM

A	0243	8301	004	0


FROM FY-004B
FROM FY-010B
FROM FY-017A
FROM FY-018A
PANEL
CONTROLLER UIC-3
CONTROLLER UIC-1
Σ
FY 007B
FSL 007B
FSL 007A
FY 007A
Σ
FR 007
FAL 007
TB 3
7+
7-
6-
6+
TB 2
2C
TB 4
TB 5
8+
8-
-
+
TRIP LOGIC
TB 1
4
PC
TB
TB

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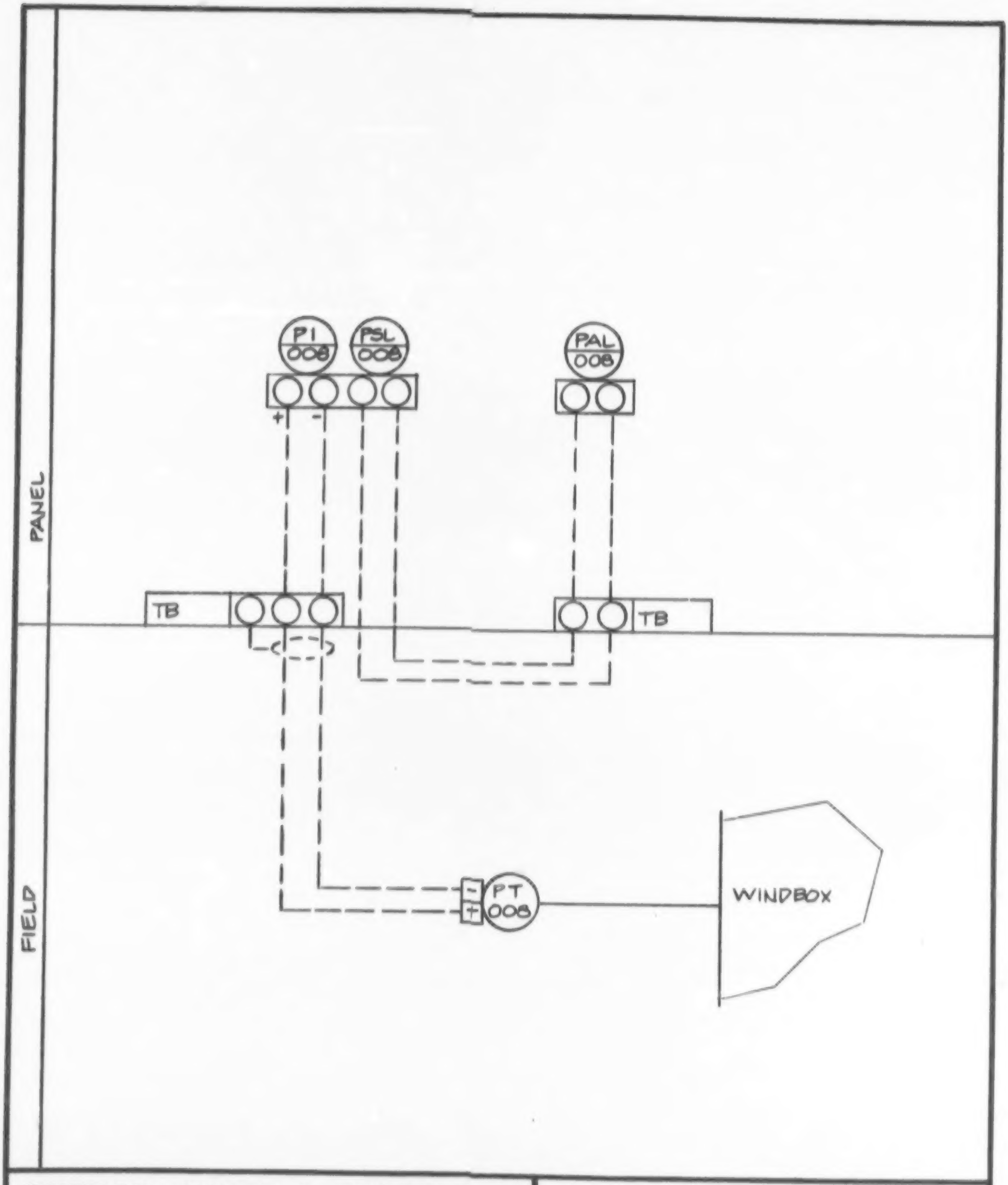
AF				0

PRIMARY AIR
. - FLOW

LOOP DIAGRAM

A	0243	8301	007	0


PANEL
FIELD
PI
008
PSL
008
PAL
008
+
-
TB
TB
PT
008
-
+
WINDBOX

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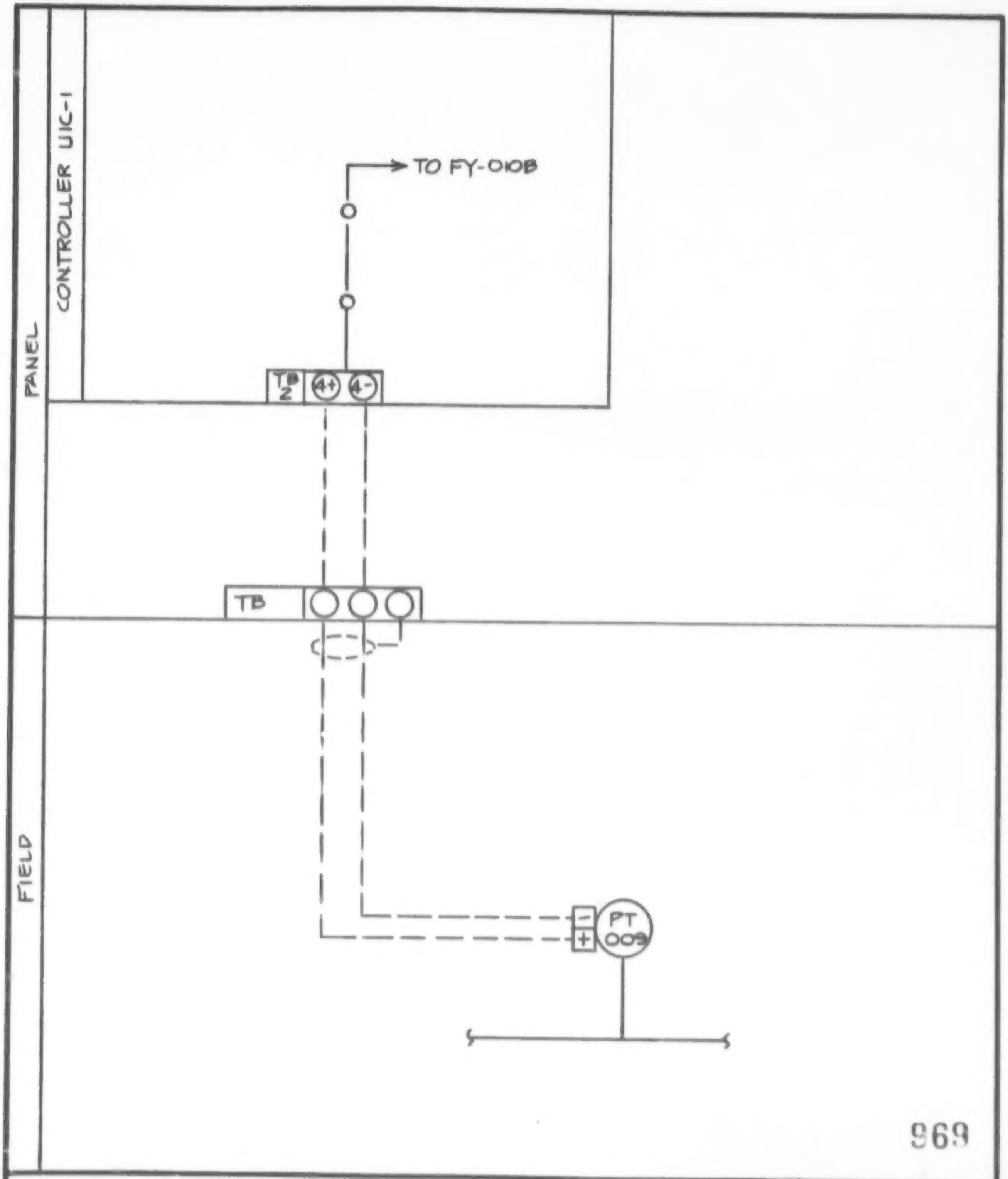
AF				

PRIMARY AIR WINDBOX
- PRESSURE

968

LOOP DIAGRAM

A	**0243**	8301	008	0


PANEL
CONTROLLER UIC-1
TO FY-010B
TB 2
4+
4-
TB
FIELD
-
+
PT 009

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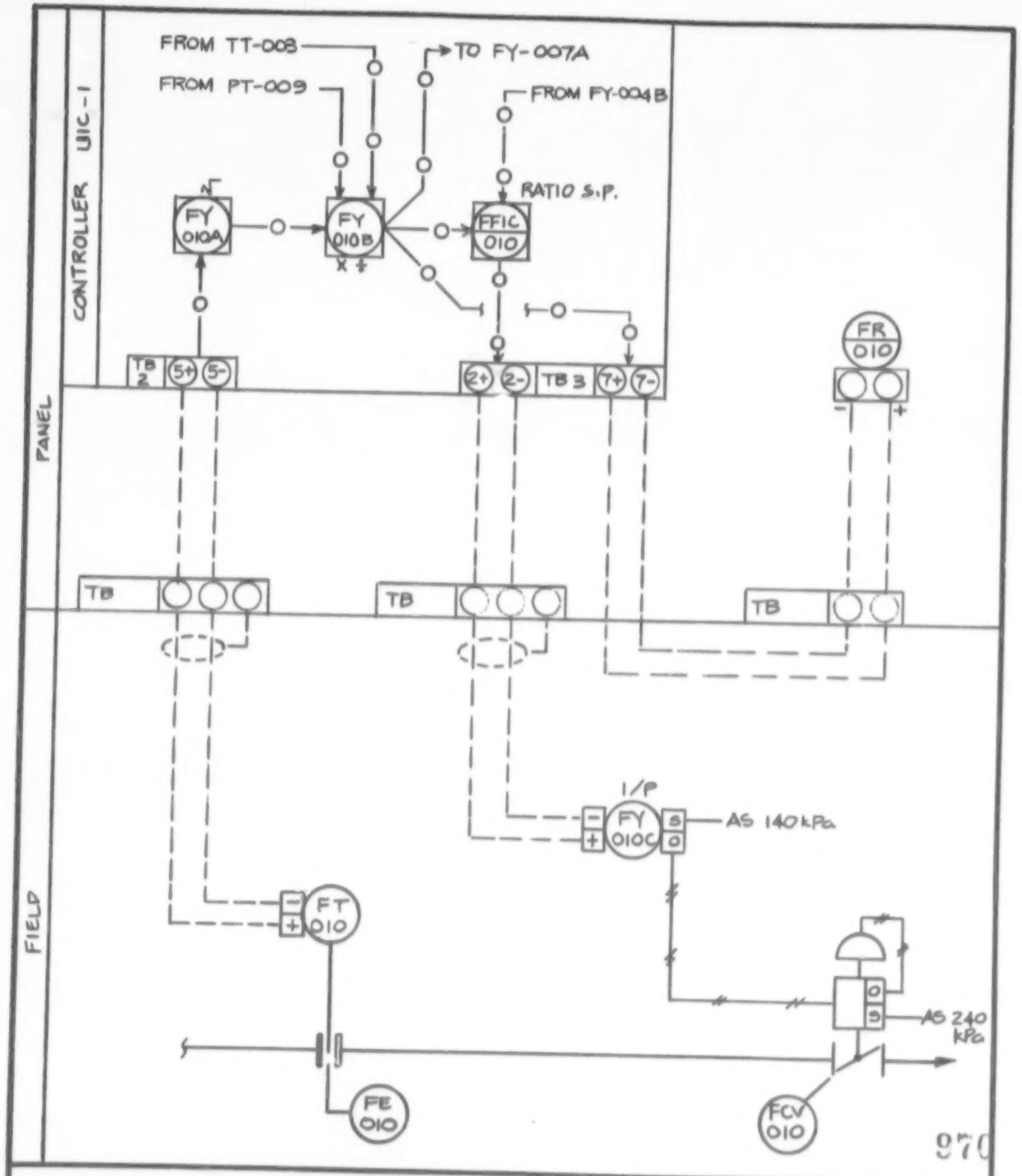
SECONDARY AIR BEFORE FLOW ELEMENT - PRESSURE

LOOP DIAGRAM

A	0243	8301	009	0



CONTROLLER UIC-1
PANEL
FIELD
FROM TT-008
FROM PT-009
TO FY-007A
FROM FY-004B
RATIO S.P.
FY 010A
FY 010B
X ÷
FFIC 010
TB 2
5+
5-
2+
2-
TB 3
7+
7-
FR 010
-
+
TB
TB
TB
I/P
FY 010C
S
O
AS 140 kPa
FT 010
AS 240 kPa
FE 010
FCV 010

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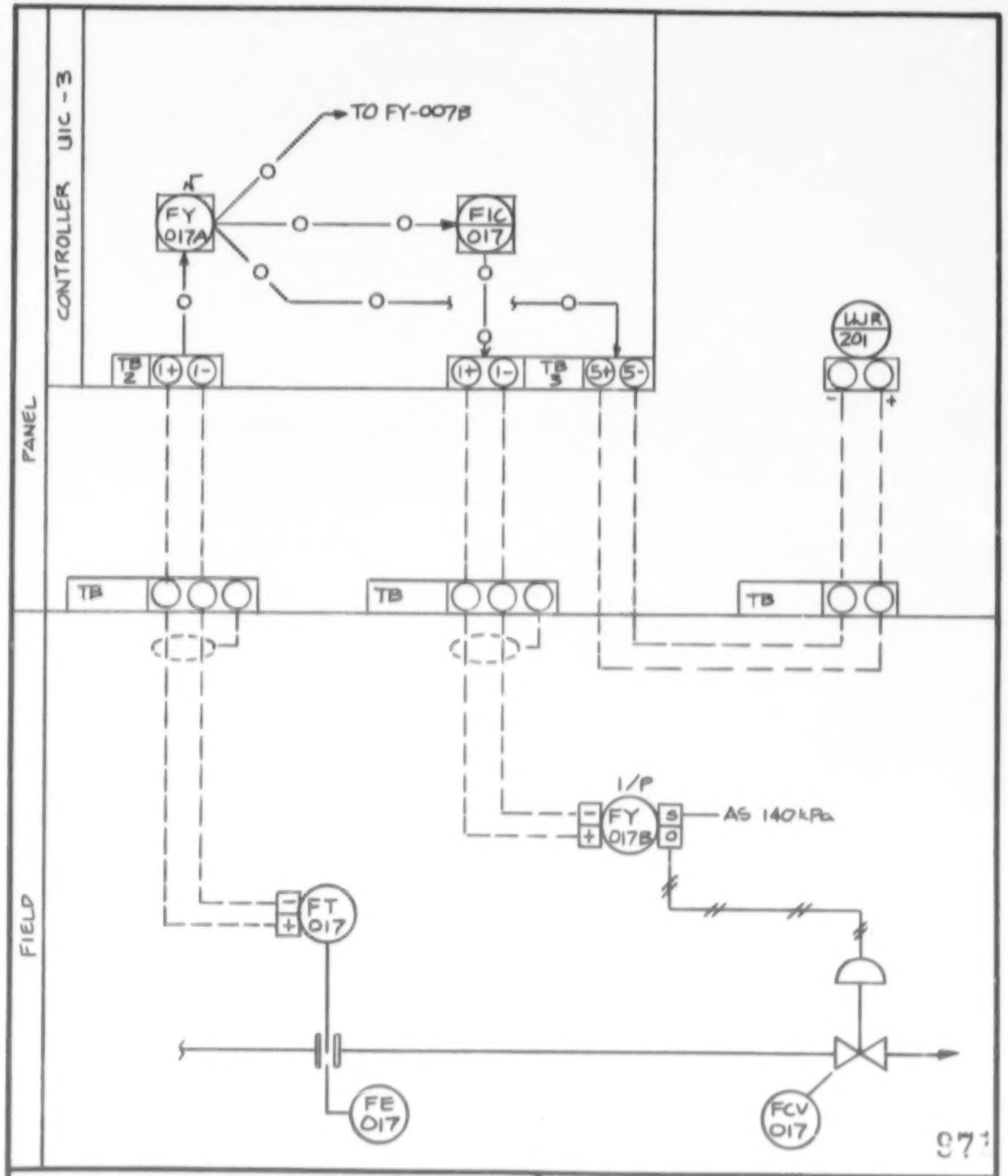
SECONDARY AIR-FLOW

LOOP DIAGRAM

A	0243	8301	010	0



CONTROLLER UIC-3
PANEL
FIELD
TO FY-007B
FY 017A
FIC 017
TB 2
1+
1-
TB 3
5+
5-
WR 201
-
+
TB
TB
TB
I/P
FY 017B
S
O
AS 140 kPa
FT 017
FE 017
FCV 017

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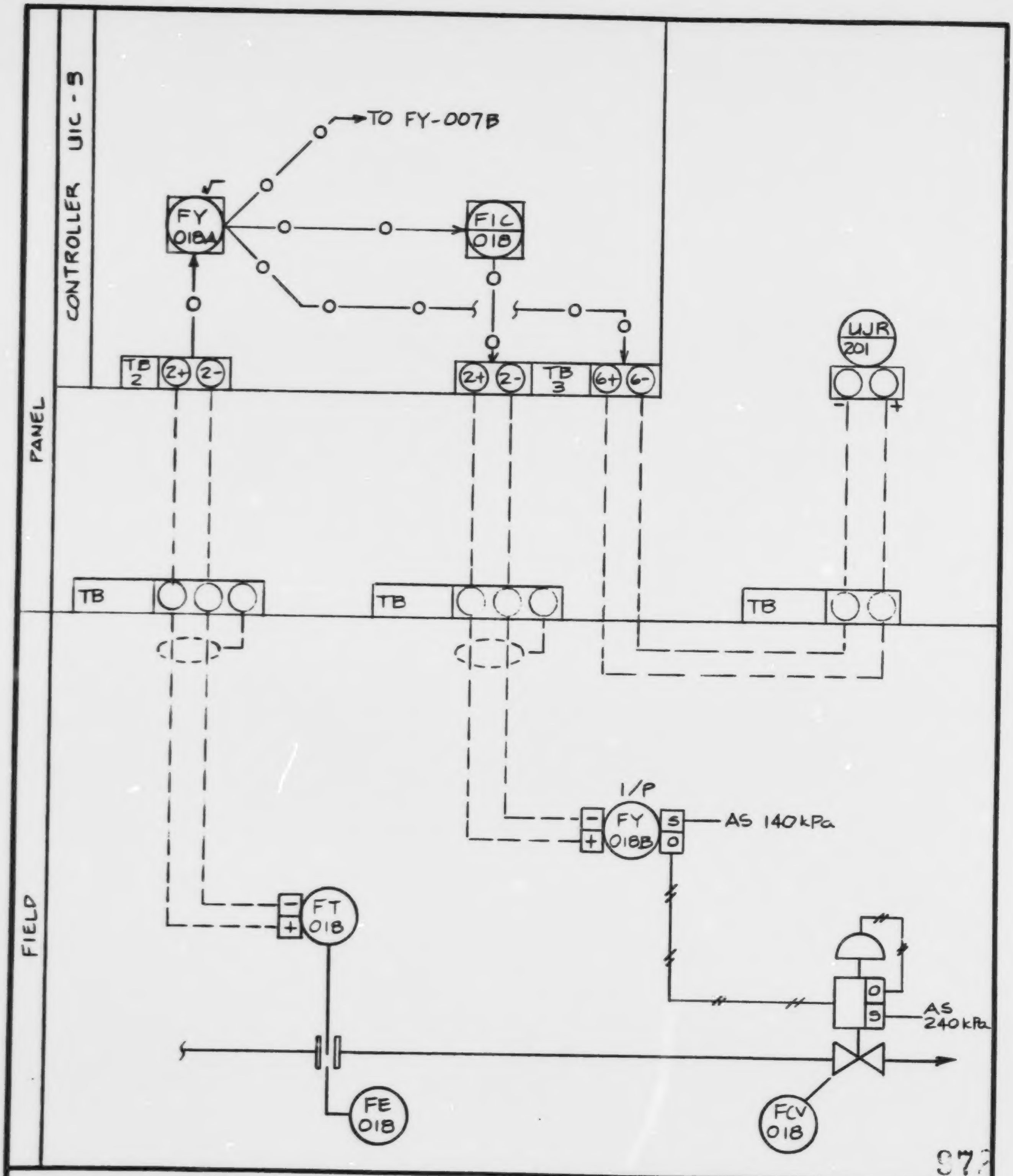
LOOP SEAL AIR
- FLOW

LOOP DIAGRAM

A	0243	8301	017	0


CONTROLLER UIC - 3
PANEL
FIELD
TO FY-007B
FY 018A
FIC 018
TB 2
2+
2-
2+
2-
TB 3
6+
6-
UJR 201
-
+
TB
TB
TB
I/P
FY 018B
S
O
AS 140 kPa
FT 018
-
+
O
S
AS 240 kPa
FE 018
FCV 018

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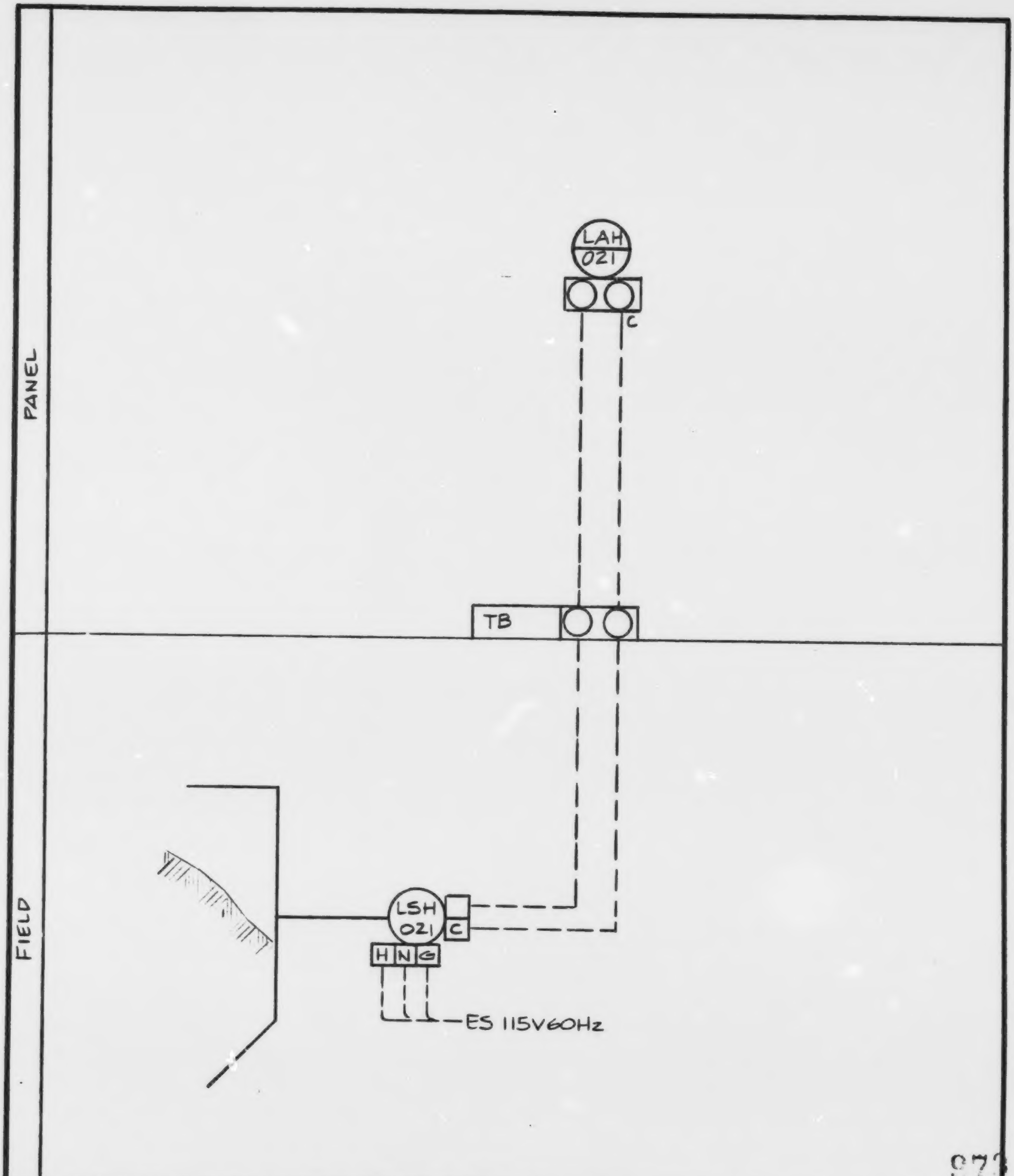
ΔF				0

FLY ASH RECYCLE AIR
- FLOW

LOOP DIAGRAM

A	0243	8301	018	0


PANEL
FIELD
LAH
021
C
TB
LSH
021
C
H
N
G
ES 115V60Hz

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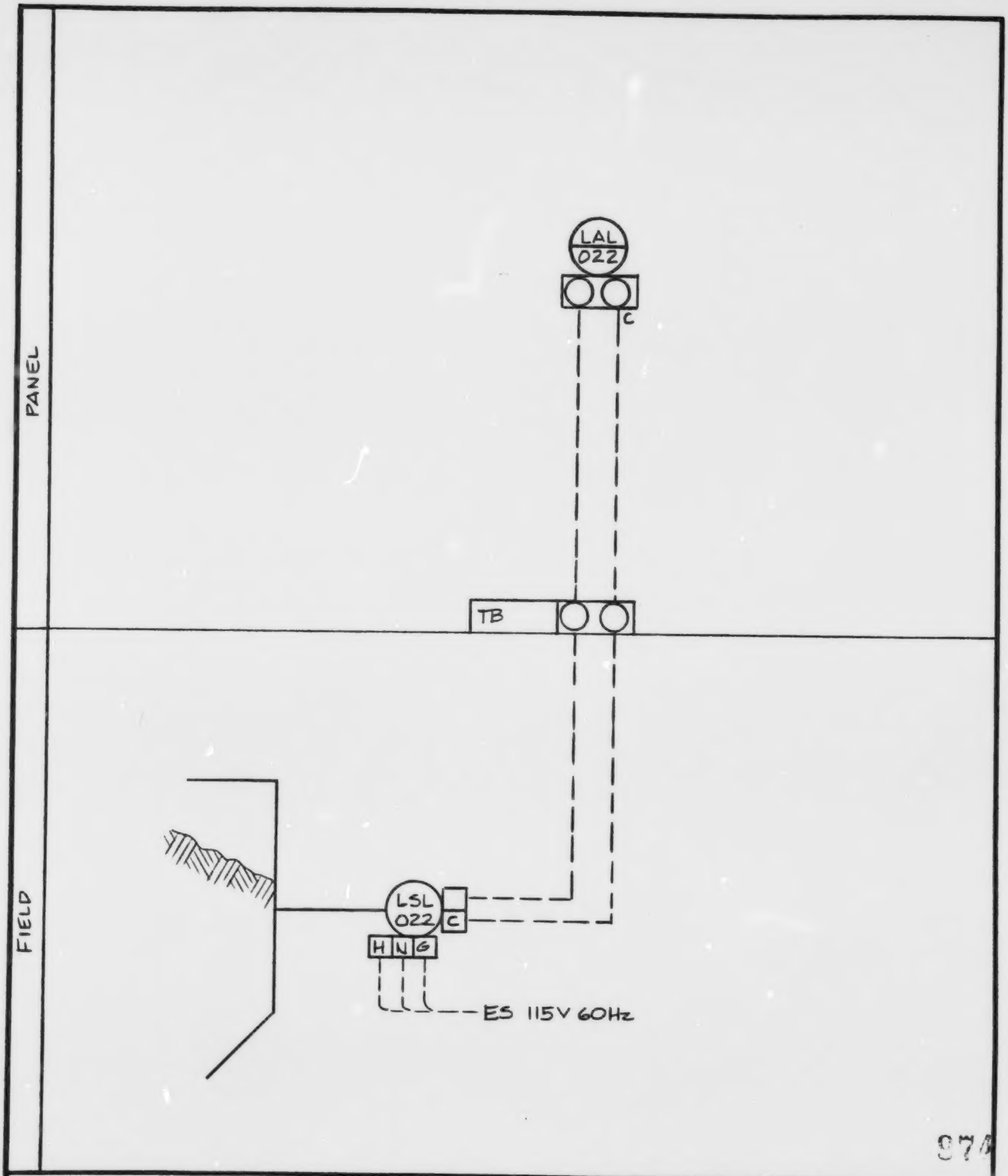
DWN	CHK	APP	DATE	RV
AF				0

FUEL BIN – LEVEL

LOOP DIAGRAM

A 0243 8301 021 0


PANEL
FIELD
LAL
022
C
TB
LSL
022
C
H N G
ES 115V 60Hz

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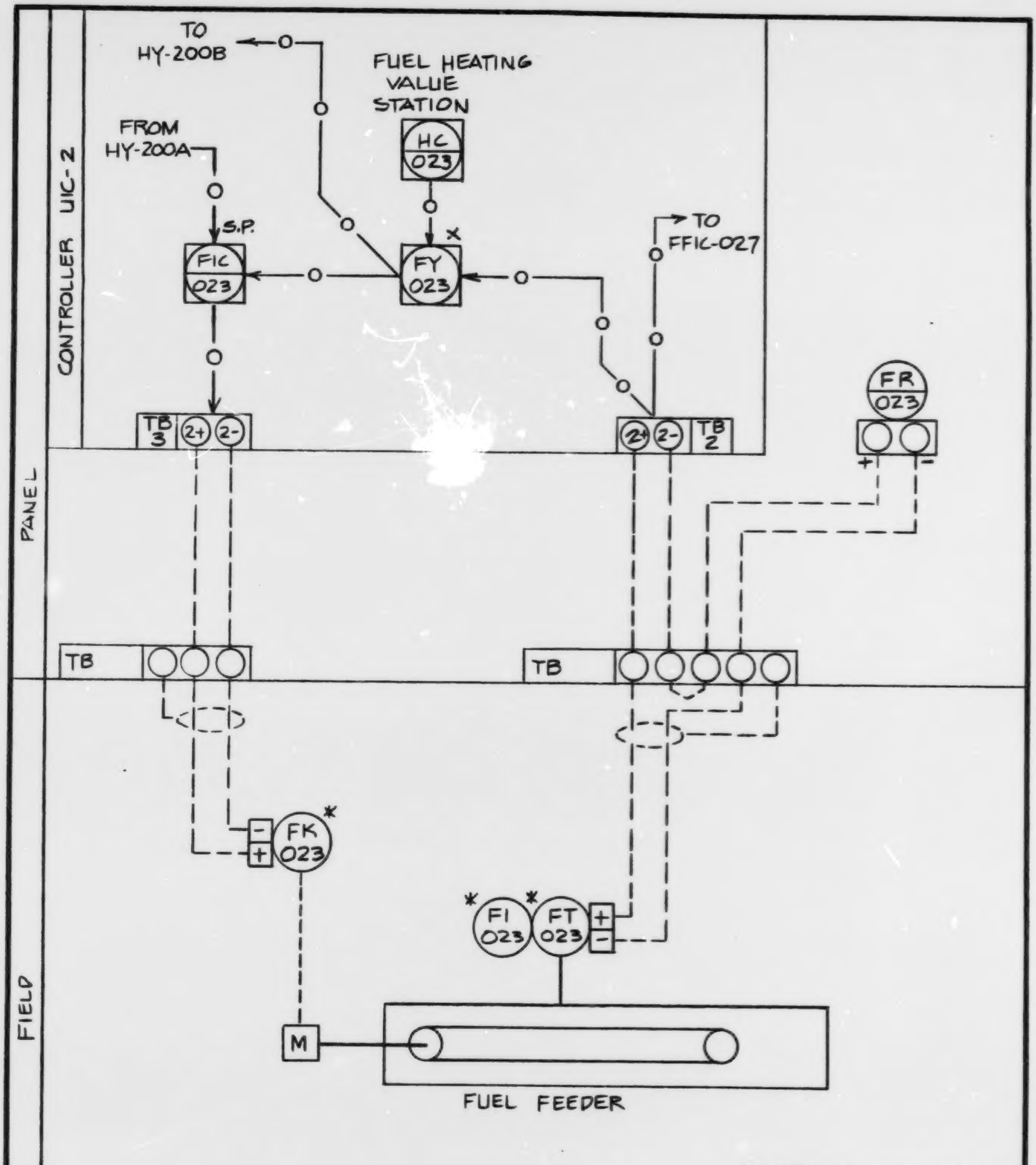
DWN	CHK	APP	DATE	RV
AF				0

FUEL BIN
- LEVEL

LOOP DIAGRAM

A	**0243**	8301	022	0


TO
HY-200B
FUEL HEATING
VALUE
STATION
HC
023
FROM
HY-200A
S.P.
FIC
023
FY
023
X
TO
FFIC-027
CONTROLLER UIC-2
TB
3
2+
2-
2+
2-
TB
2
FR
023
+
-
PANEL
TB
TB
-
+
FK
023
*
*
FI
023
*
FT
023
+
-
FIELD
M
FUEL FEEDER

*SUPPLIED WITH FEEDER

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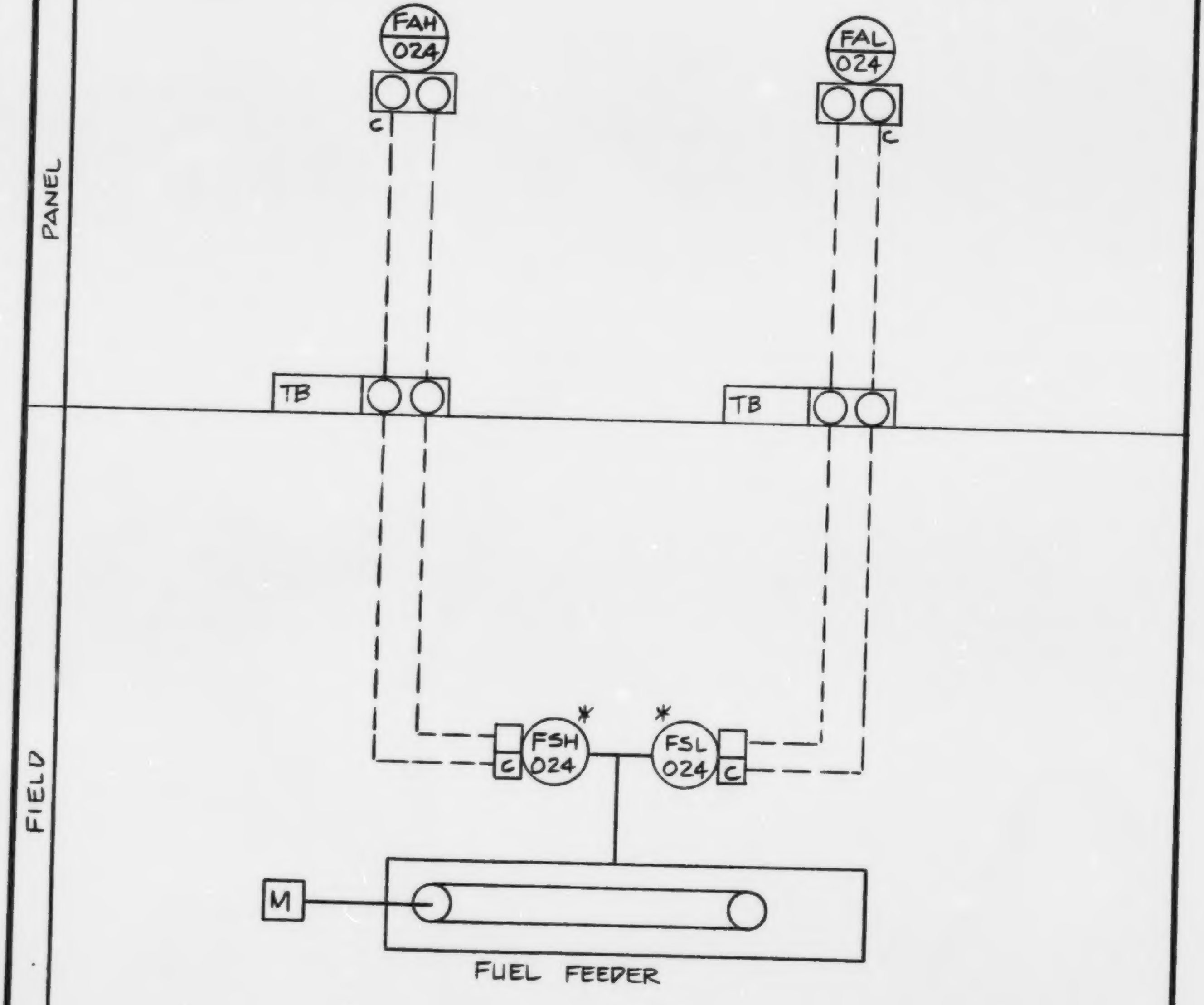
DWN	CHK	APP	DATE	RV
AF				0

FUEL TO COMBUSTOR
– FLOW

LOOP DIAGRAM

A	0243	8301	023	0


PANEL
FIELD
FAH
024
FAL
024
C
C
TB
TB
FSH
024
FSL
024
C
C
*
*
M
FUEL FEEDER

*SUPPLIED WITH FEEDER

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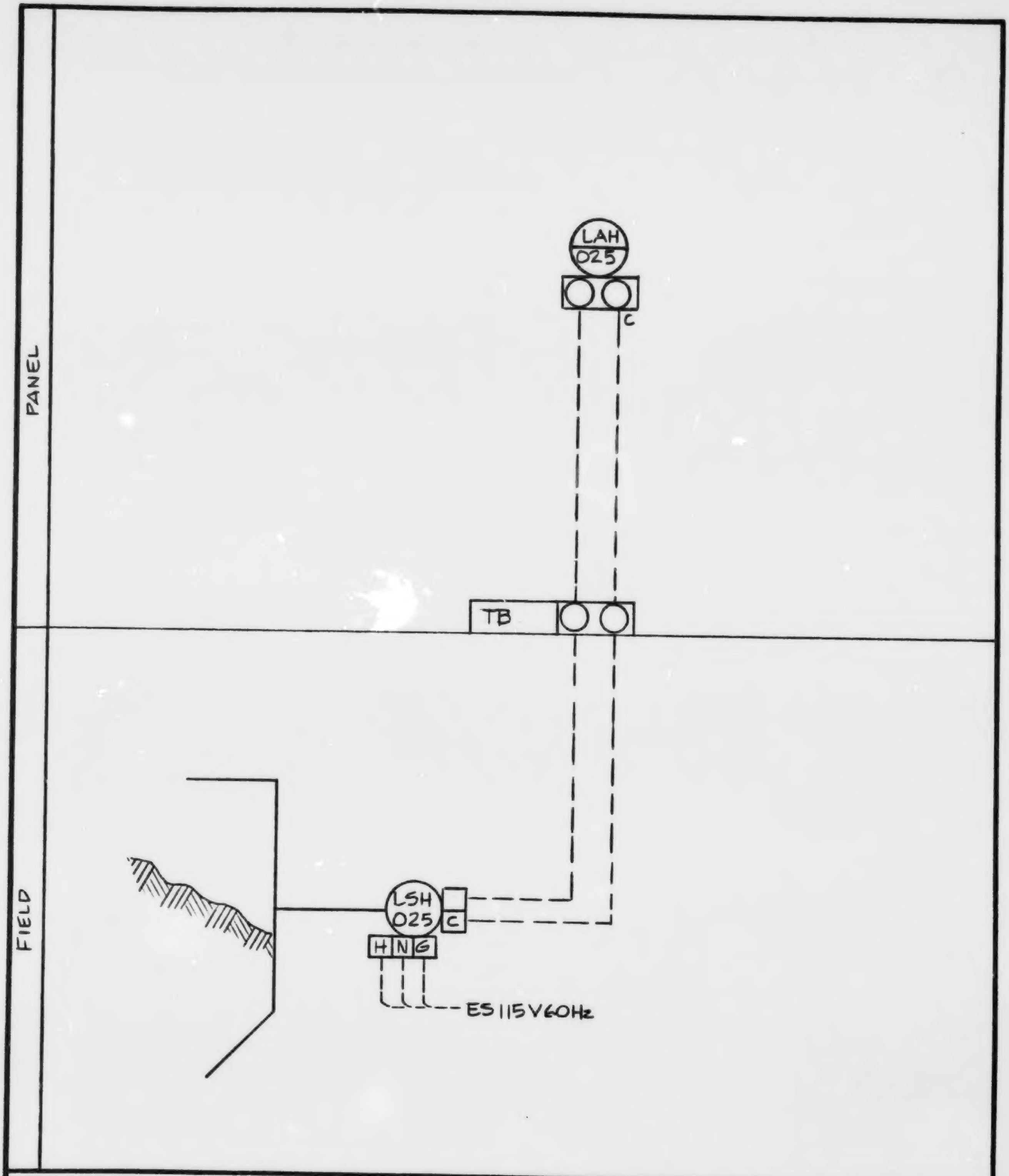
DWN	CHK	APP	DATE	RV
AF				O

FUEL FEEDER
– FLOW

LOOP DIAGRAM

A	0243	8301	024	O


PANEL
FIELD
LAH
025
C
TB
LSH
025
C
H
N
G
ES 115V60Hz

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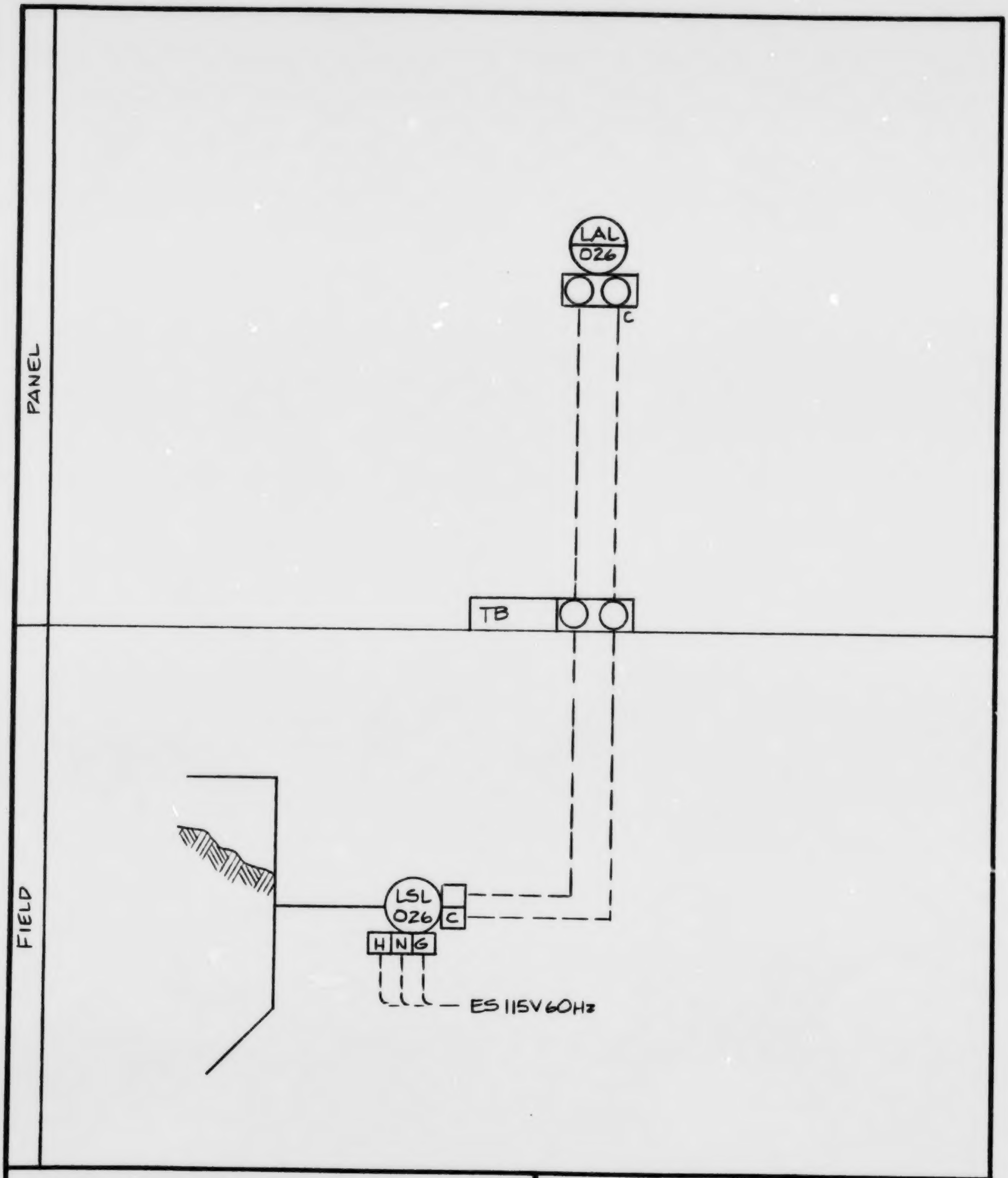
DWN	CHK	APP	DATE	RV
AF				0

LIMESTONE BIN - LEVEL

LOOP DIAGRAM

A	0243	8301	025	


PANEL
FIELD
LAL
026
C
TB
LSL
026
C
H
N
G
ES 115V60Hz

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97

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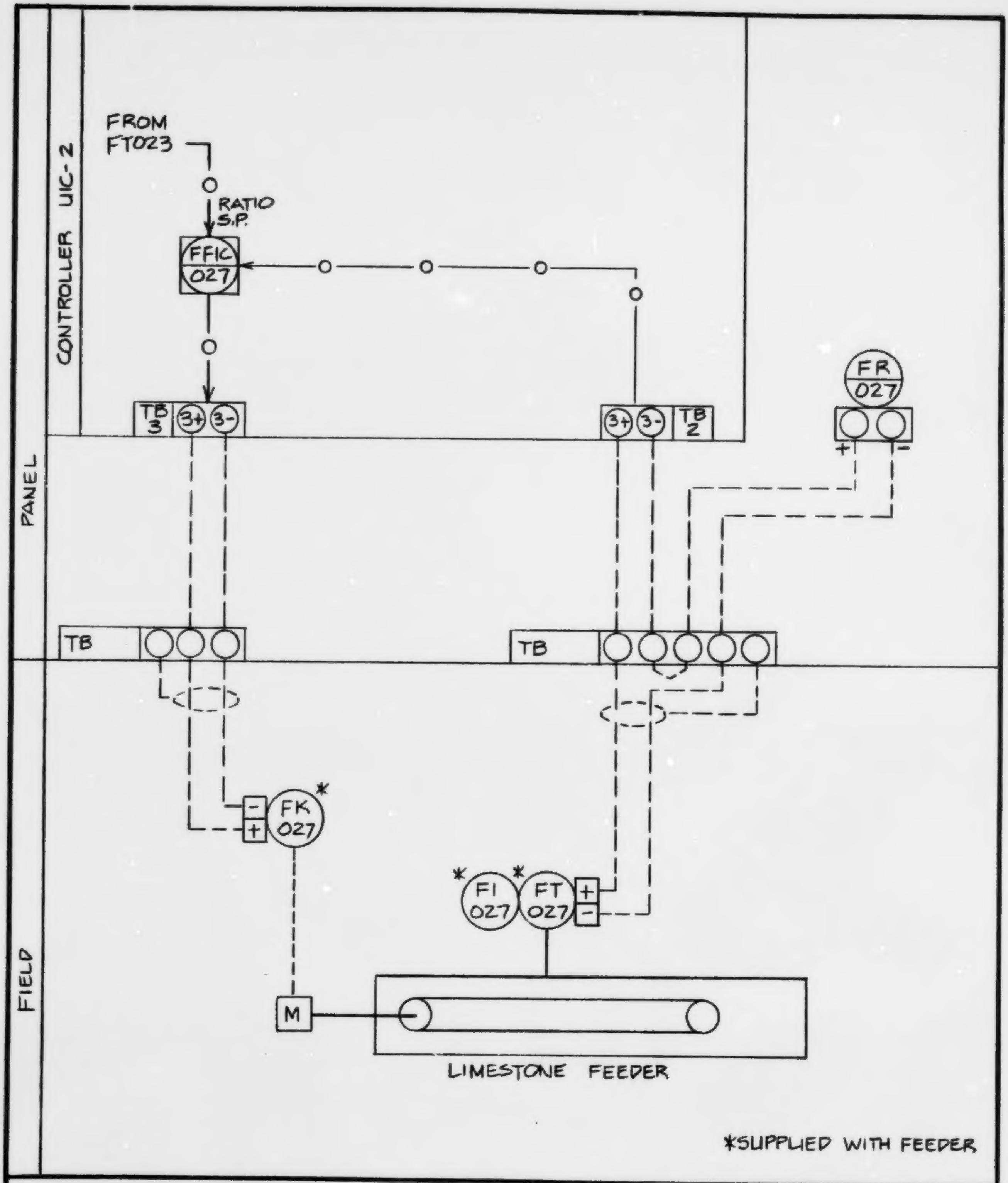
DWN	CHK	APP	DATE	RV
AF				0

LIMESTONE BIN - LEVEL

LOOP DIAGRAM

A	0243	8301	026	0


CONTROLLER UIC-2
PANEL
FIELD
FROM
FT023
RATIO
S.P.
FFIC
027
TB
3
3+
3-
3+
3-
TB
2
FR
027
+
-
TB
TB
-
+
FK
027
*
*
FI
027
*
FT
027
+
-
M
LIMESTONE FEEDER

*SUPPLIED WITH FEEDER

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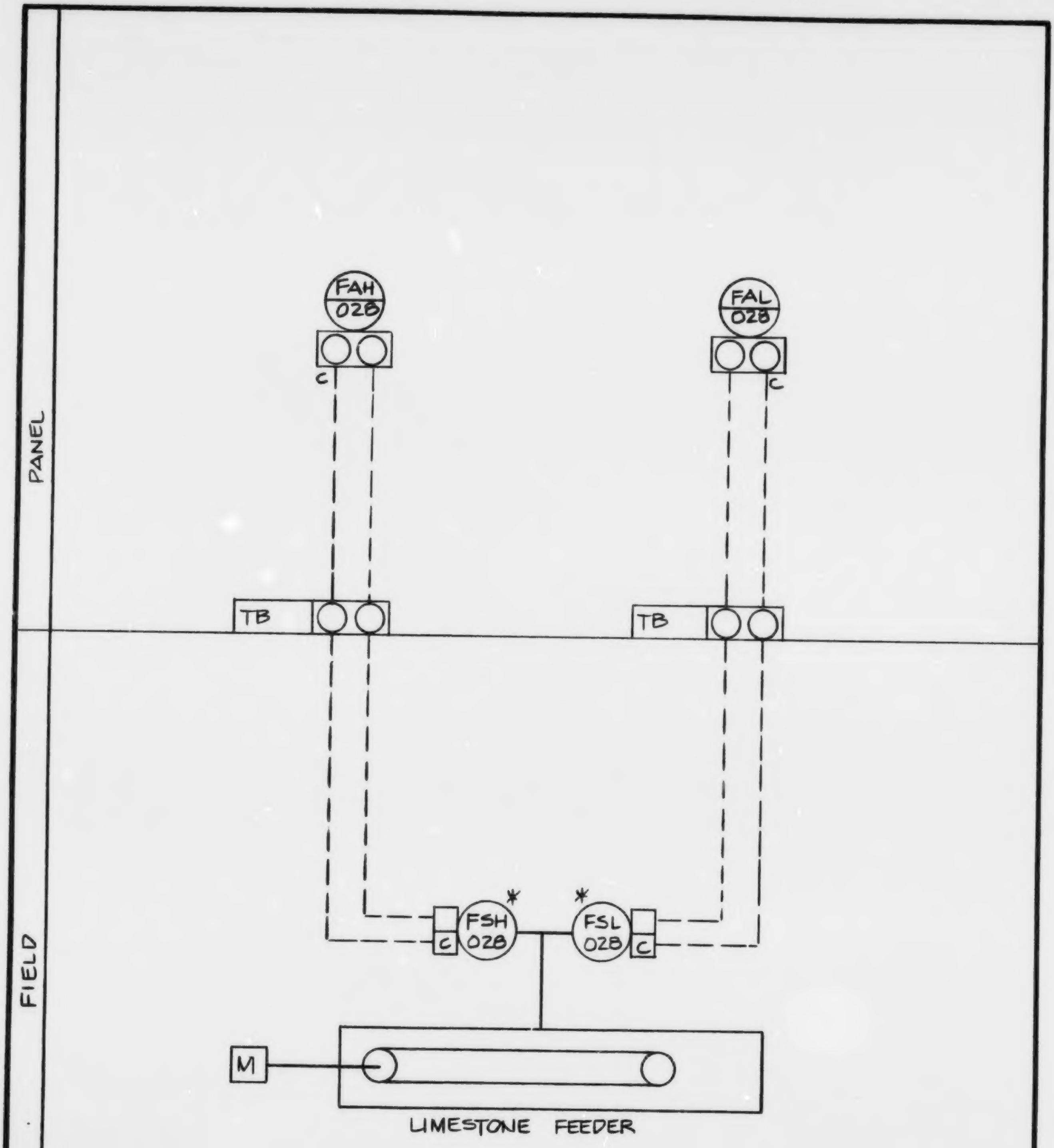
DWN	CHK	APP	DATE	RV
AF				0

LIMESTONE TO COMBUSTOR
- FLOW

LOOP DIAGRAM

A	0243	8301	027	0


PANEL
FIELD
FAH
028
FAL
028
C
C
TB
TB
FSH
028
FSL
028
C
C
*
*
M
LIMESTONE FEEDER

*SUPPLIED WITH FEEDER

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DWN	CHK	APP	DATE	RV
AF				0

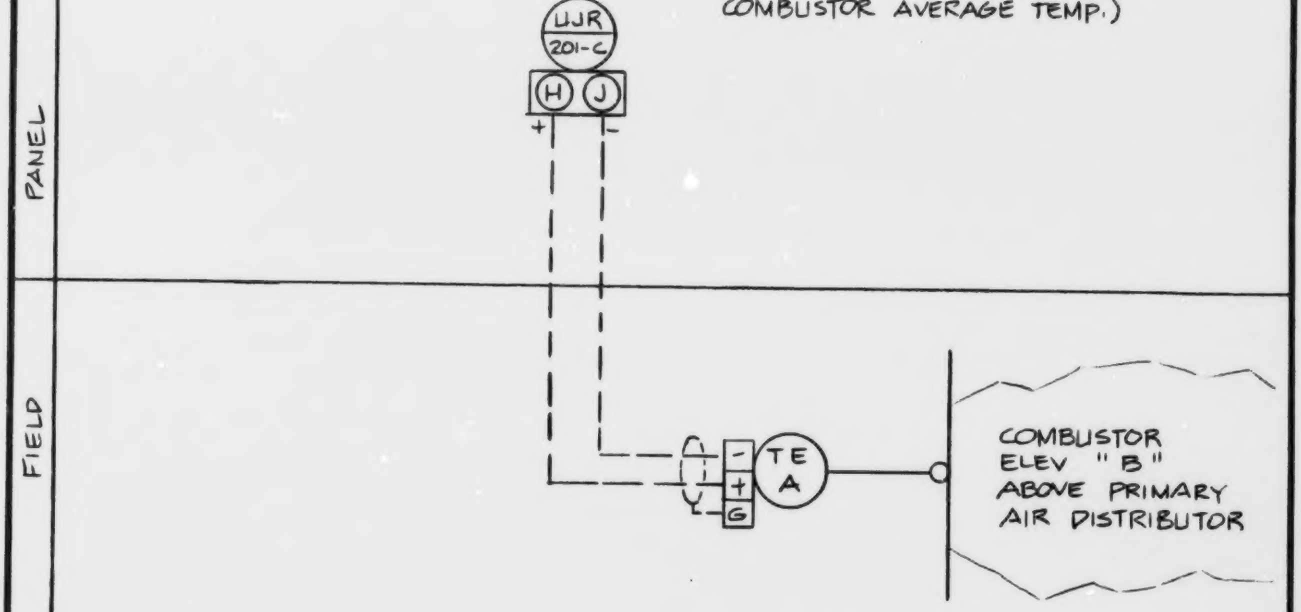
LIMESTONE FEEDER - FLOW

LOOP DIAGRAM

A	**0243**	8301	028	0

TAG NO.	ELEV (mm)	DATA LOGGER POINT	PANEL TERM. BLOCK	PANEL TERMINALS			DATA LOGGER TERMINALS		
A	B	C	D	E	F	G	H	J	
030	150								
031	150								
032	460								
033	760								
034	1070								
035	1680								
036	2290								
037	2900								
038	3510								
039	4110								
040	4720								
041	5330								
042	5940								

* SEE SHEET 2 (THREE OF THESE TEMPERATURE ELEMENTS TO BE SELECTED FOR DEVELOPING COMBUSTOR AVERAGE TEMP.)


PANEL
FIELD
UJR
201-C
H
J
+
-
-
+
G
TE
A
COMBUSTOR
ELEV "B"
ABOVE PRIMARY
AIR DISTRIBUTOR

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DWN	CHK	APP	DATE	RV
ΔF				0

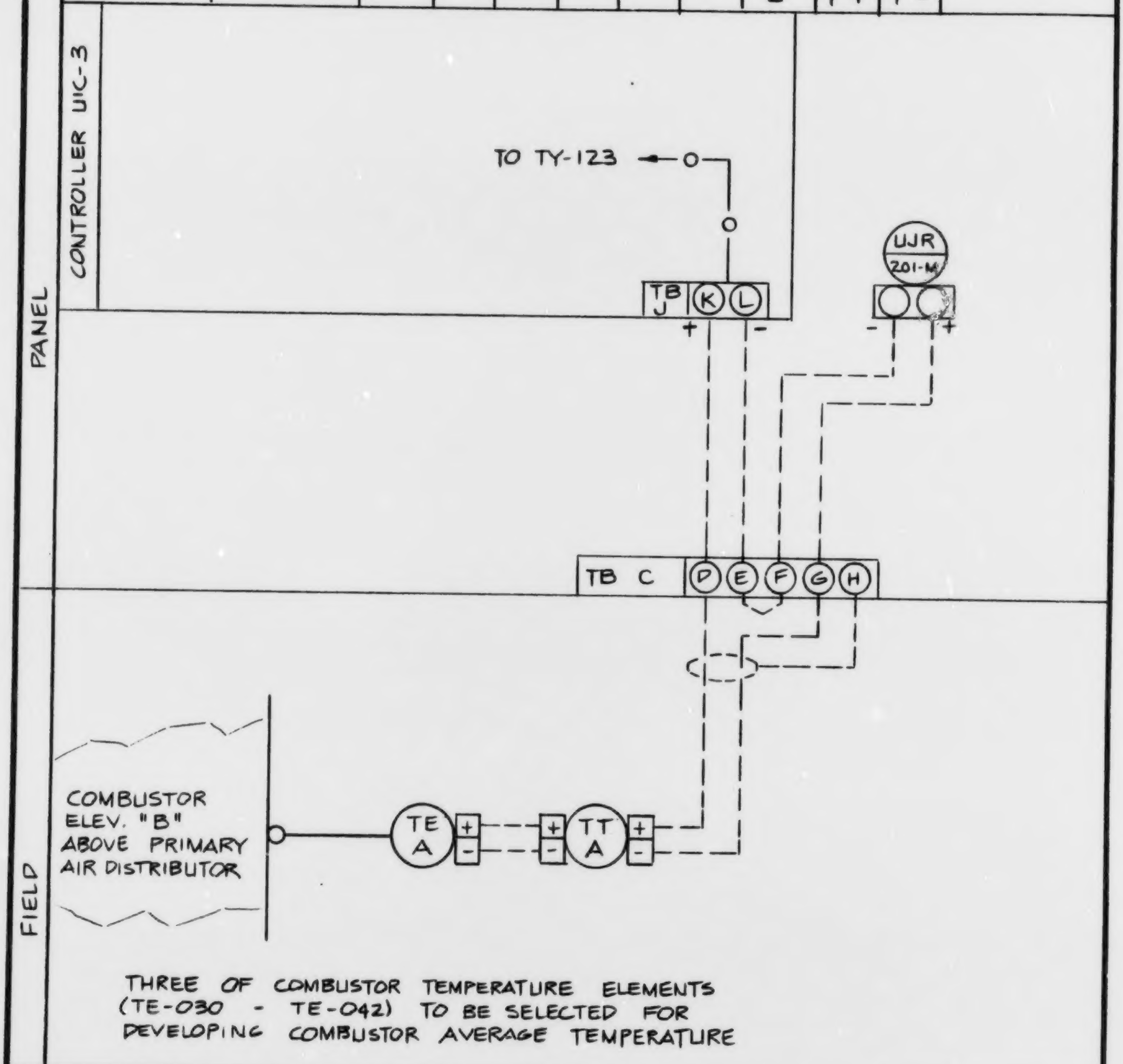
COMBUSTOR - TEMPERATURES

LOOP DIAGRAM

A | **0243** | 8301 | 030-042 | 0

SHEET 1

TAG NO.	ELEV. (mm)	PANEL TERMINALS						CONTROLLER TERMNL			DATA LOG. PT.
A	B	C	D	E	F	G	H	J	K	L	M
								2	5 +	5 -	
								2	6 +	6 -	
								2	7 +	7 -	


PANEL
CONTROLLER UIC-3
TO TY-123
UJR
201-M
TB J
K
L
+
-
-
+
TB C
D
E
F
G
H
FIELD
COMBUSTOR
ELEV. "B"
ABOVE PRIMARY
AIR DISTRIBUTOR
TE
A
TT
A
+
-
+
-
+
-

THREE OF COMBUSTOR TEMPERATURE ELEMENTS (TE-030 - TE-042) TO BE SELECTED FOR DEVELOPING COMBUSTOR AVERAGE TEMPERATURE

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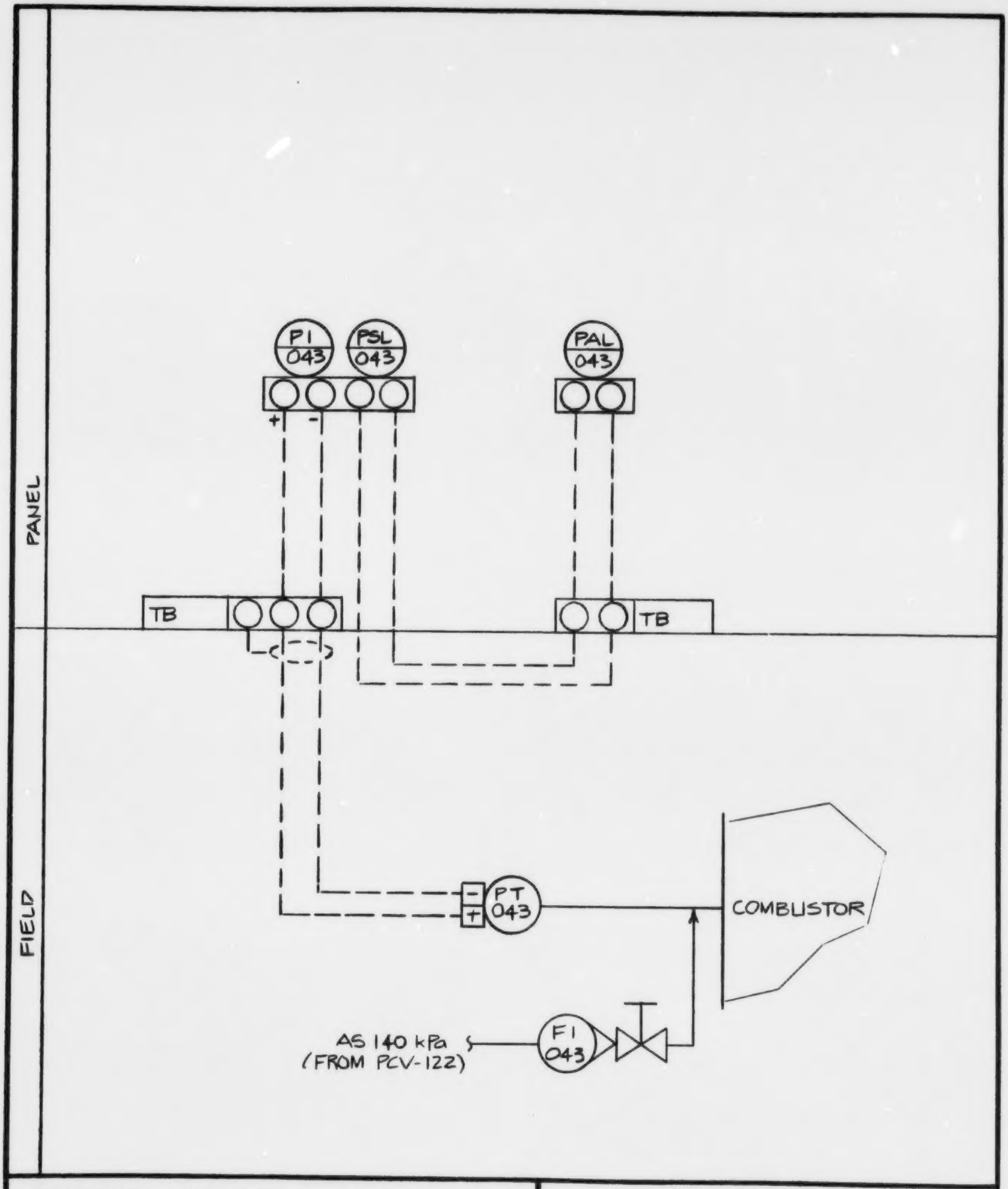
DWN	CHK	APP	DATE	RV
AF				0

COMBUSTOR - TEMPERATURES

LOOP DIAGRAM

A	0243	8301	030-042	0

SHEET 2


PANEL
FIELD
PI
043
PSL
043
PAL
043
+
-
TB
TB
-
+
PT
043
COMBUSTOR
AS 140 kPa
(FROM PCV-122)
FI
043

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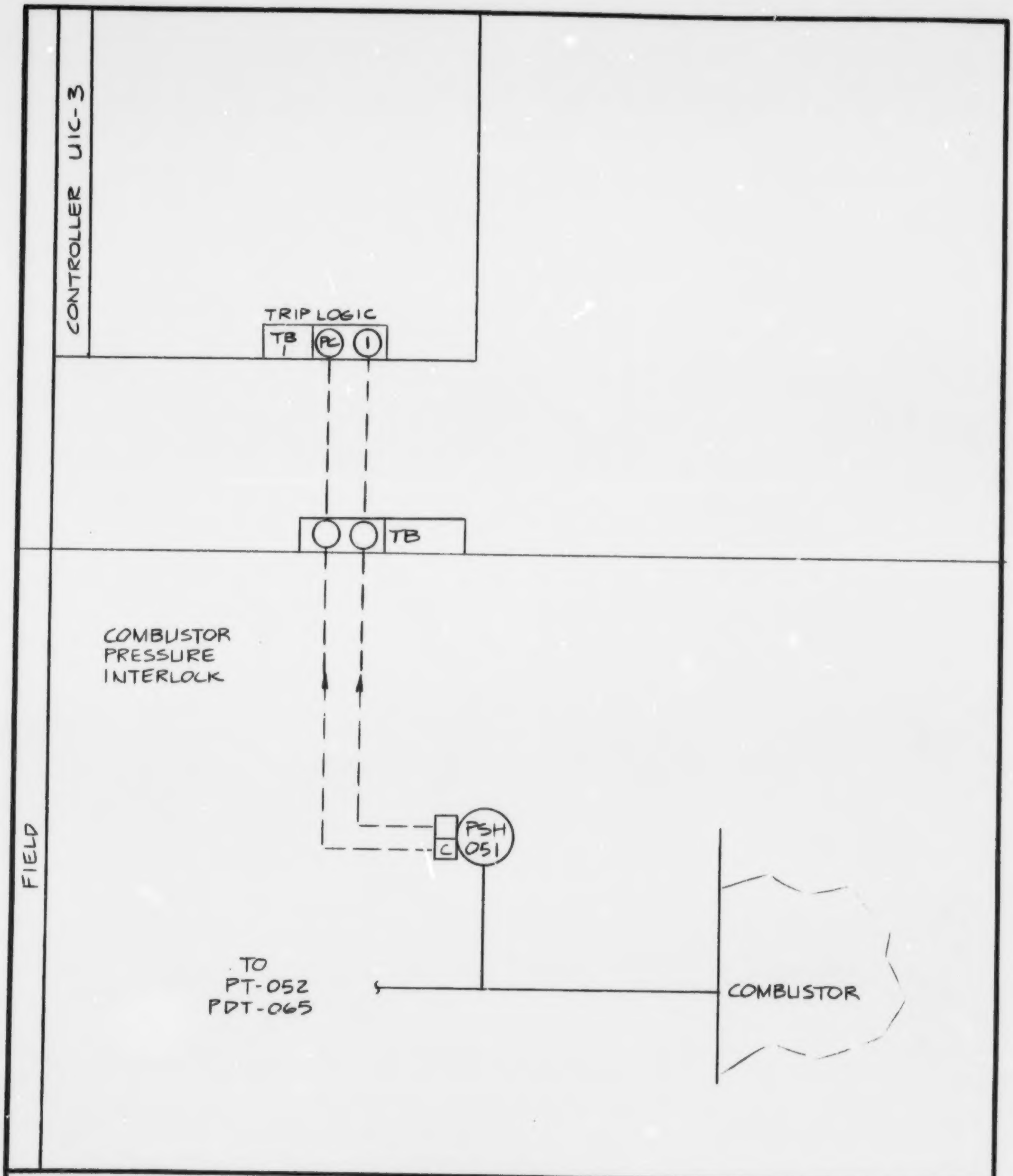
AF				O

FLUIDIZED BED (ABOVE PRIMARY AIR DISTRIBUTOR) - PRESSURE

LOOP DIAGRAM

A	**0243**	8301	043	O


CONTROLLER UIC-3
TRIP LOGIC
TB
1
PC
1
TB
COMBUSTOR
PRESSURE
INTERLOCK
FIELD
PSH
051
C
TO
PT-052
PDT-065
COMBUSTOR

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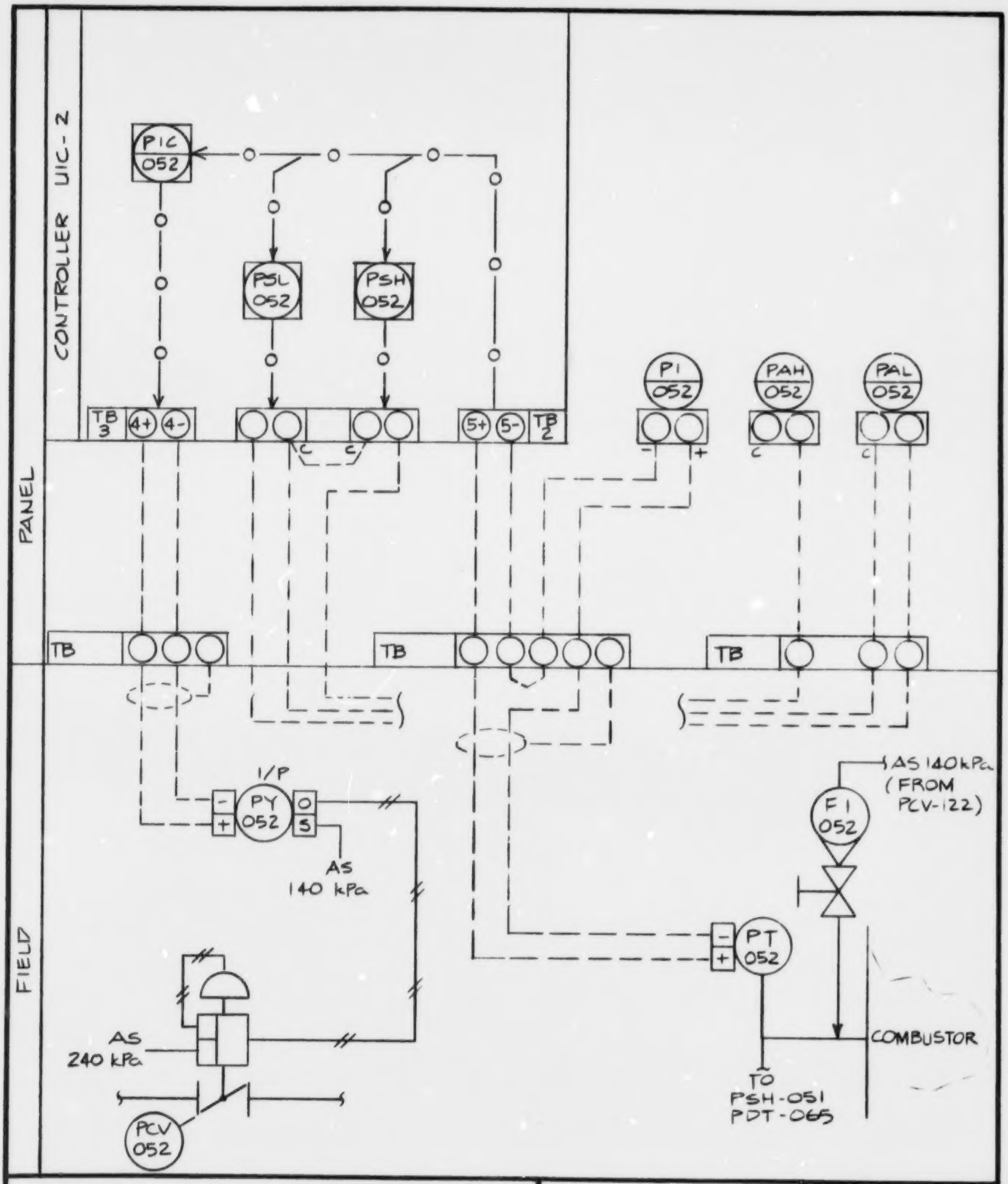
AF				0

COMBUSTOR
- PRESSURE

LOOP DIAGRAM

A	0243	8301	051	0


CONTROLLER UIC - 2
PANEL
FIELD
PIC 052
PSL 052
PSH 052
TB 3
4+
4-
C
5+
5-
TB 2
PI 052
PAH 052
PAL 052
-
+
TB
I/P
PY 052
O
S
AS 140 kPa
AS 240 kPa
PCV 052
AS 140 kPa (FROM PCV-122)
FI 052
PT 052
COMBUSTOR
TO PSH-051 PDT-065

085

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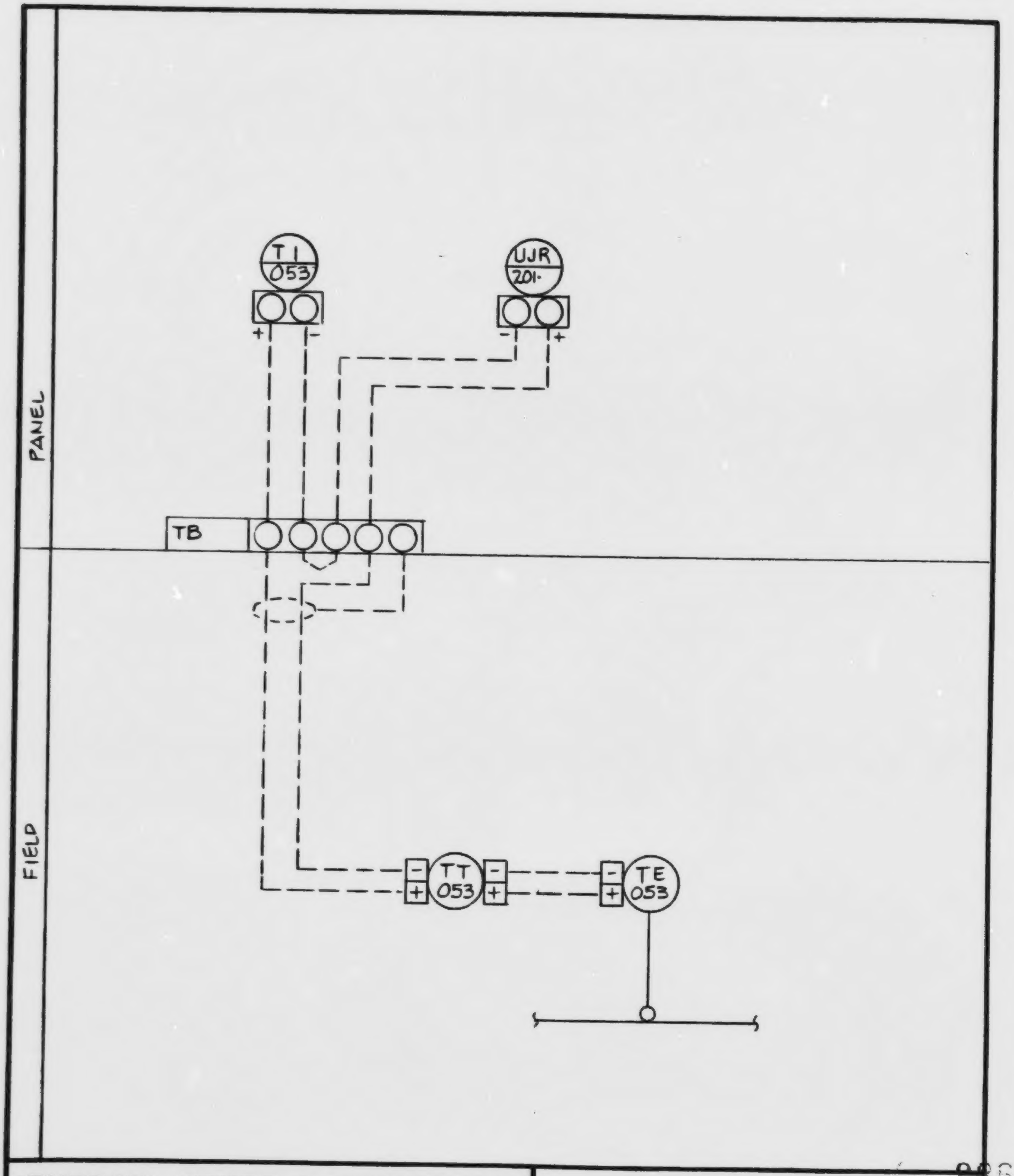
COMBUSTOR
- PRESSURE

LOOP DIAGRAM

A	0243	8301	052	0



PANEL
FIELD
TI
053
UJR
201-
+
-
-
+
TB
TT
053
TE
053
-
+
-
+
-
+

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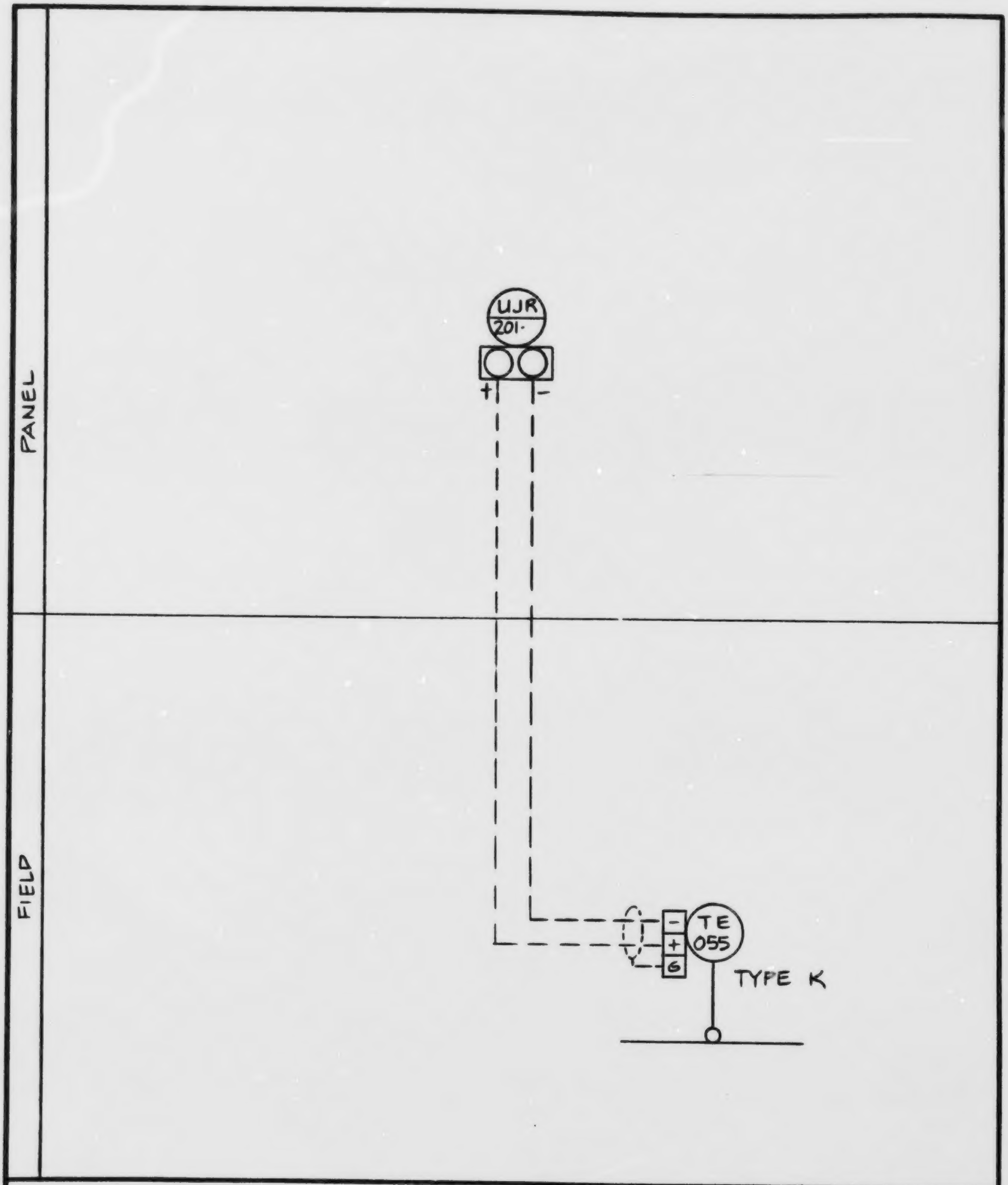
DWN	CHK	APP	DATE	RV
AF				0

COMBUSTOR OUTLET DUCT TO
CYCLONE - TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	053	0


PANEL
FIELD
UJR
201-
+
-
TE
055
-
+
G
TYPE K

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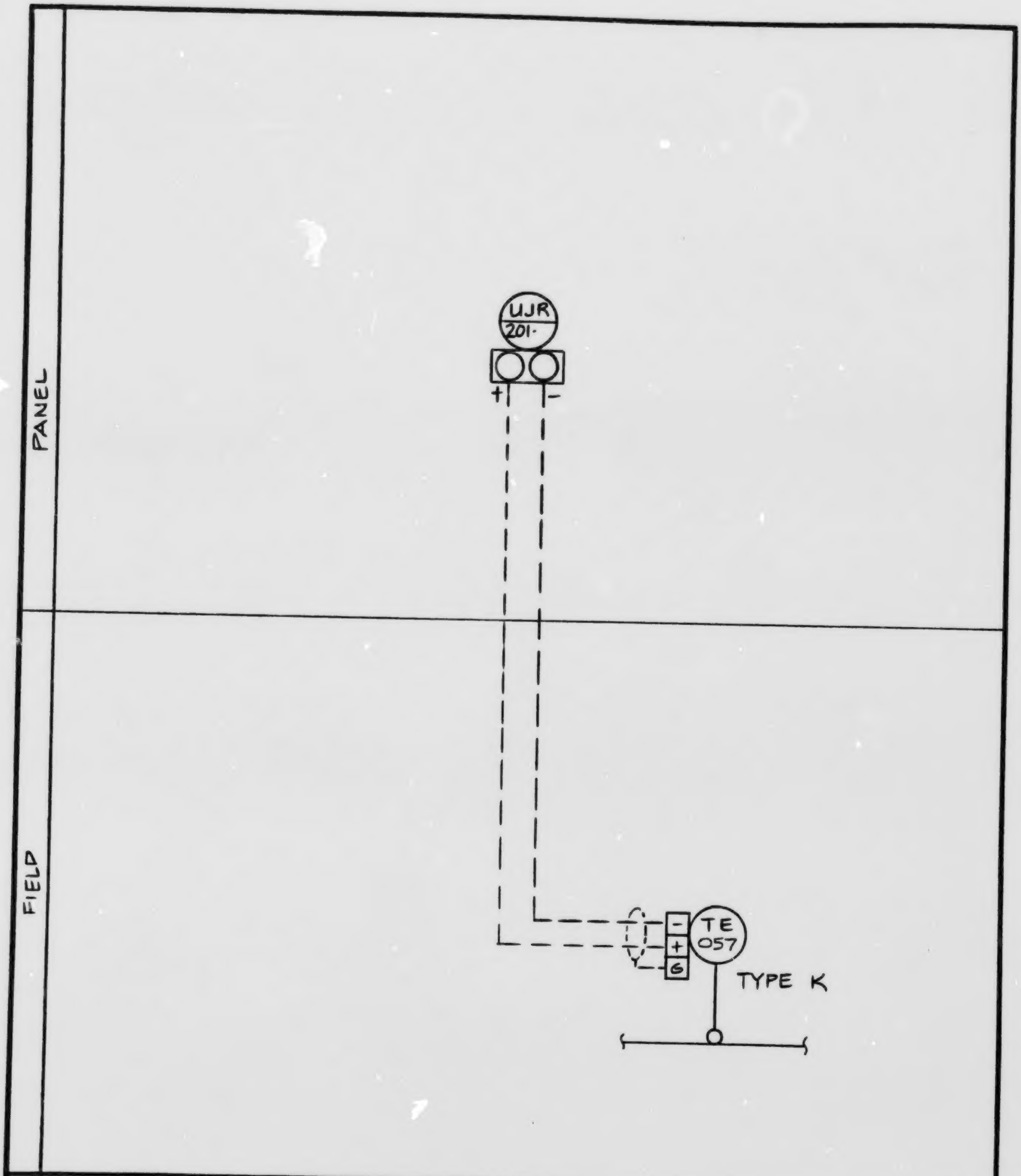
DWN	CHK	APP	DATE	RV
AF				0

COMBUSTOR CYCLONE
- TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	055	0


PANEL
FIELD
UJR
201-
+
-
TE
057
-
+
G
TYPE K

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

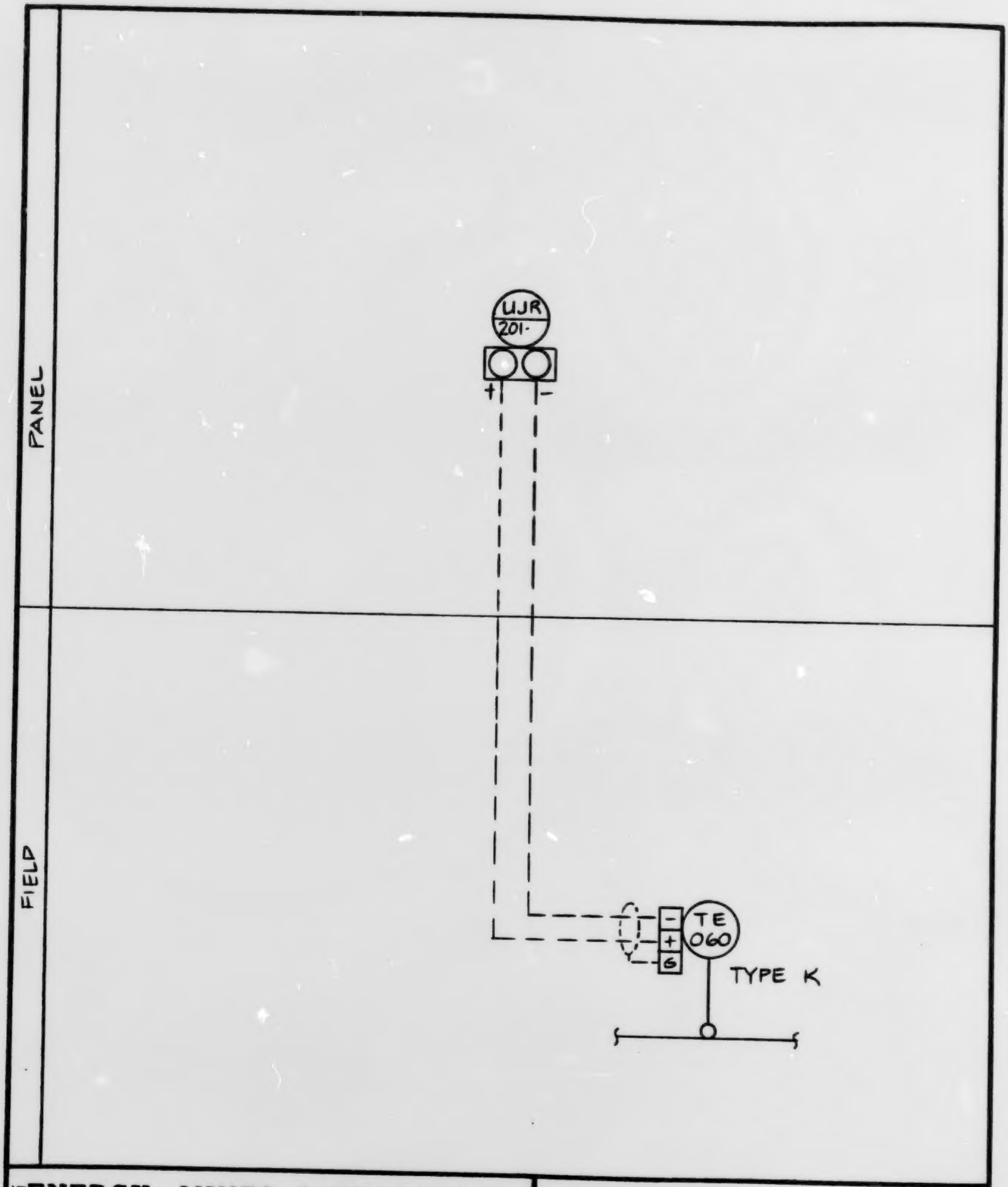
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

RECYCLE LOOP BEFORE LOOP SEAL AERATION PORTS - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	057	0


PANEL
FIELD
UJR
201-
+
-
-
+
G
TE
060
TYPE K

ENERGY, MINES & RESOURCES CANADA

A R F B C
RESEARCH FACILITY

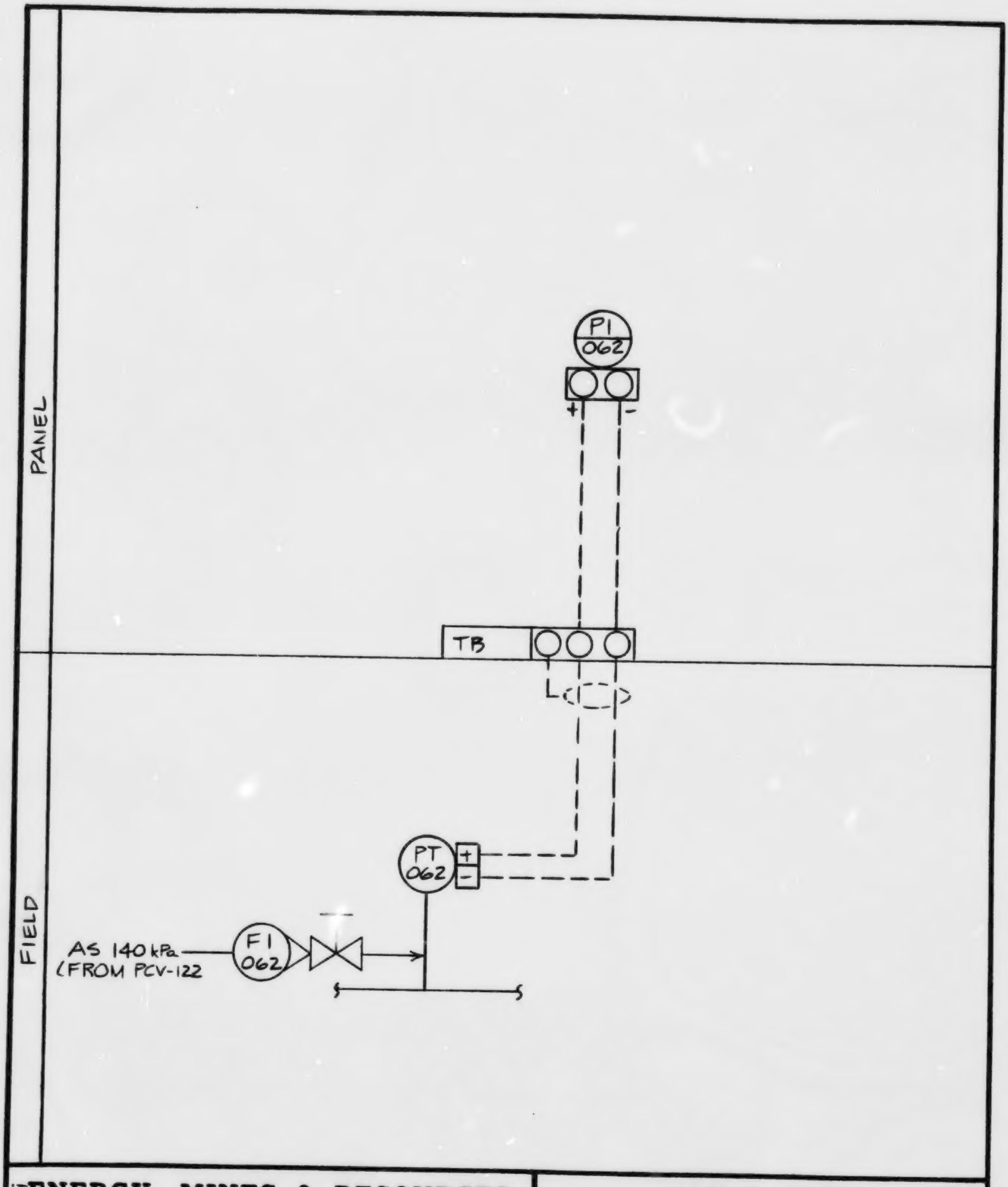
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

RECYCLE LOOP AFTER LOOP SEAL
AERATION PORTS - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	060	0


PI
062
+
-
PANEL
TB
FIELD
PT
062
+
-
AS 140 kPa
(FROM PCV-122
FI
062

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

990

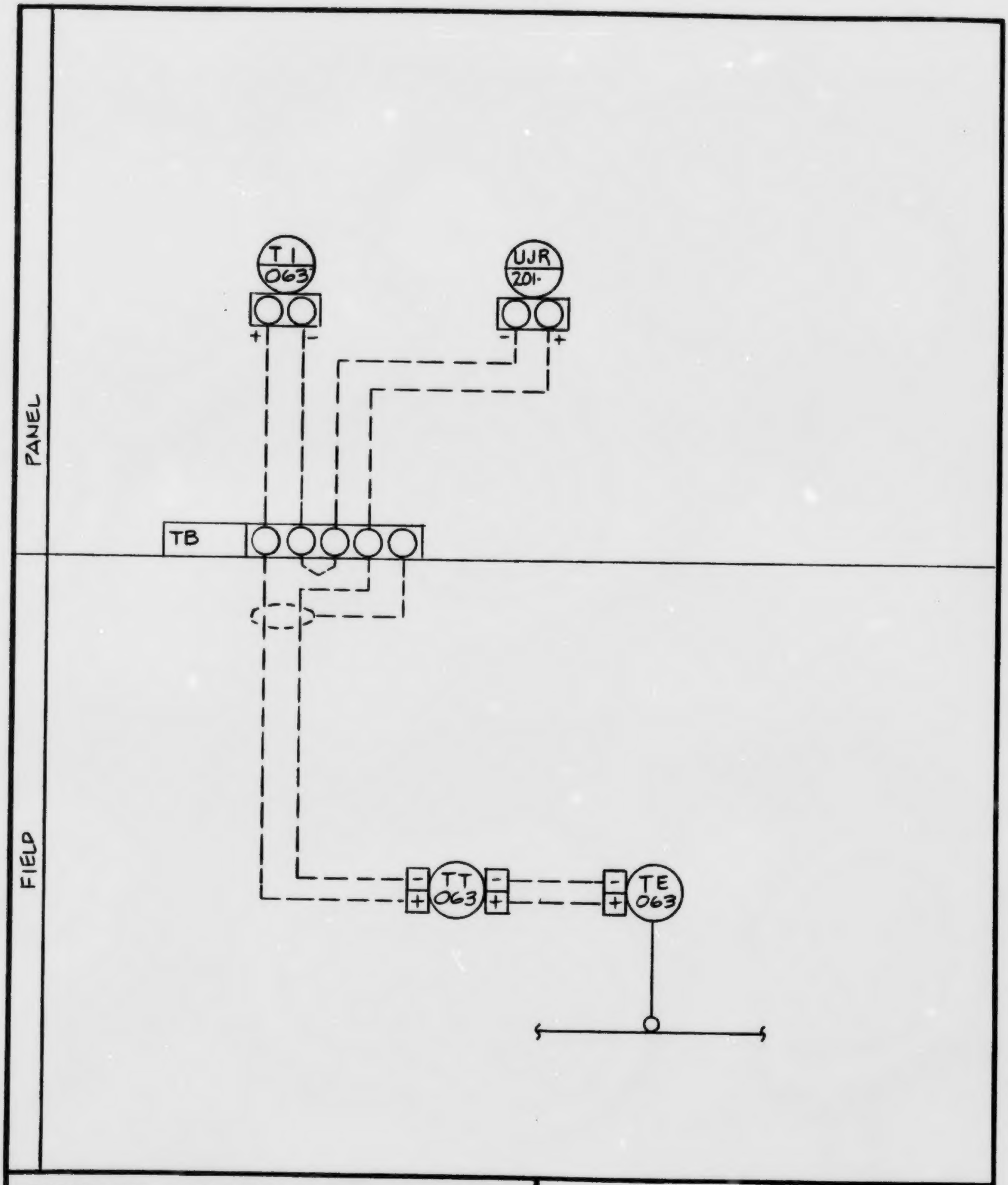
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

CYCLONE GAS OUTLET
- PRESSURE

LOOP DIAGRAM

A	0243	8301	062	0


PANEL
FIELD
TI
063
UJR
201
+
-
-
+
TB
TT
063
TE
063
-
+
-
+
-
+

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

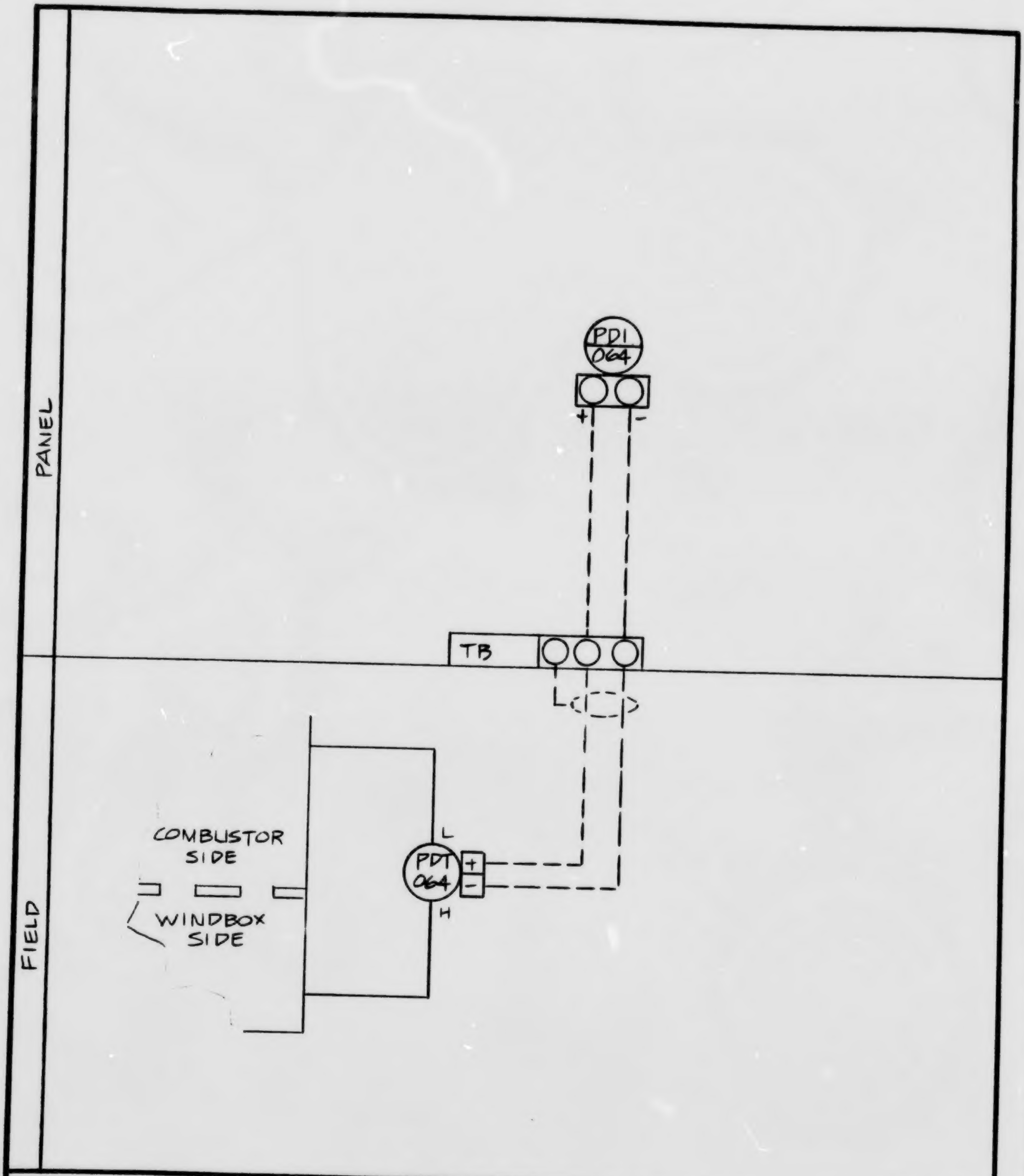
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

CYCLONE GAS OUTLET
- TEMPERATURE

LOOP DIAGRAM

A	0243	8301	063	0


PANEL
PDI
064
+
-
TB
FIELD
L
COMBUSTOR SIDE
PDT
064
+
-
H
WINDBOX SIDE

ENERGY, MINES & RESOURCES CANADA

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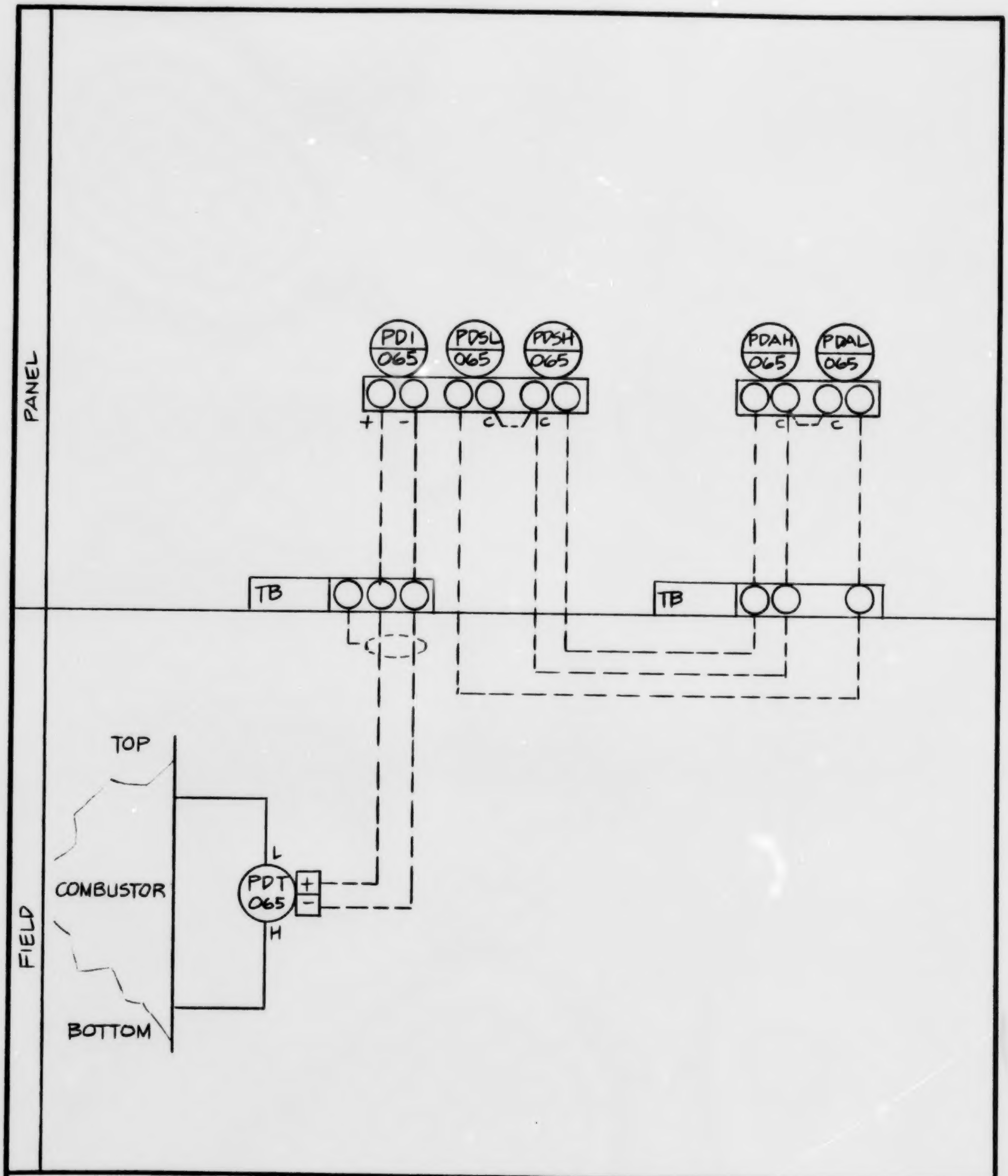
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PRIMARY AIR DISTRIBUTION NOZZLES
- DIFFERENTIAL PRESSURE

LOOP DIAGRAM

A	**0243**	8301	064	0


PANEL
PDI 065
PDSL 065
PDSH 065
PDAH 065
PDAL 065
+
-
c
c
c
c
TB
TB
FIELD
TOP
COMBUSTOR
BOTTOM
L
PDT 065
+
-
H

ENERGY, MINES & RESOURCES CANADA

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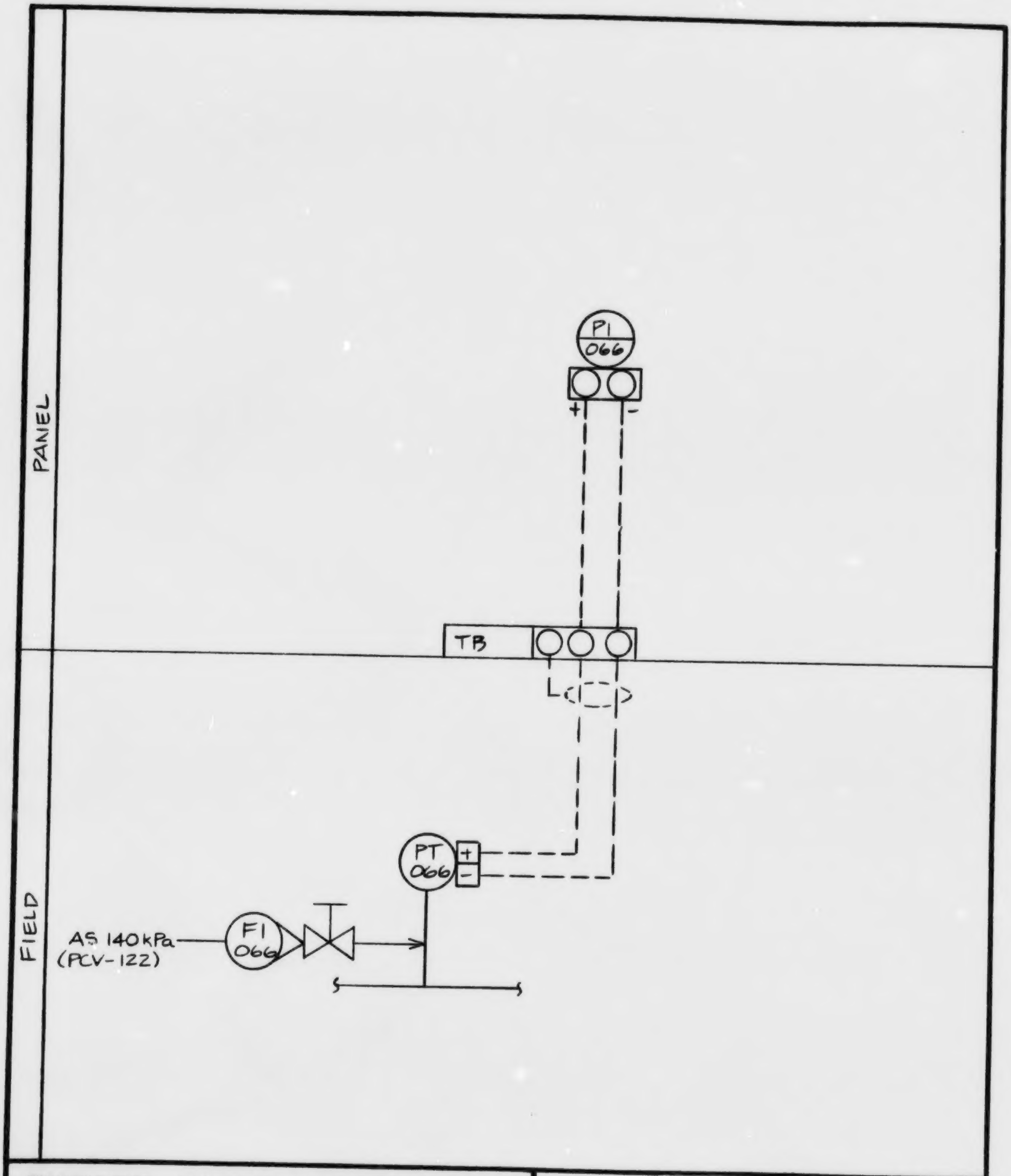
integ
Intercontinental Engineering Ltd.

DWN	CHK	APP	DATE	RV
AF				0

FLUIDIZED BED BASE TO COMBUSTOR OUTLET - DIFFERENTIAL PRESSURE

LOOP DIAGRAM

A	0243	8301	065	0


PANEL
FIELD
PI
066
+
-
TB
PT
066
+
-
FI
066
AS 140kPa
(PCV-122)

ENERGY, MINES & RESOURCES
CANADA

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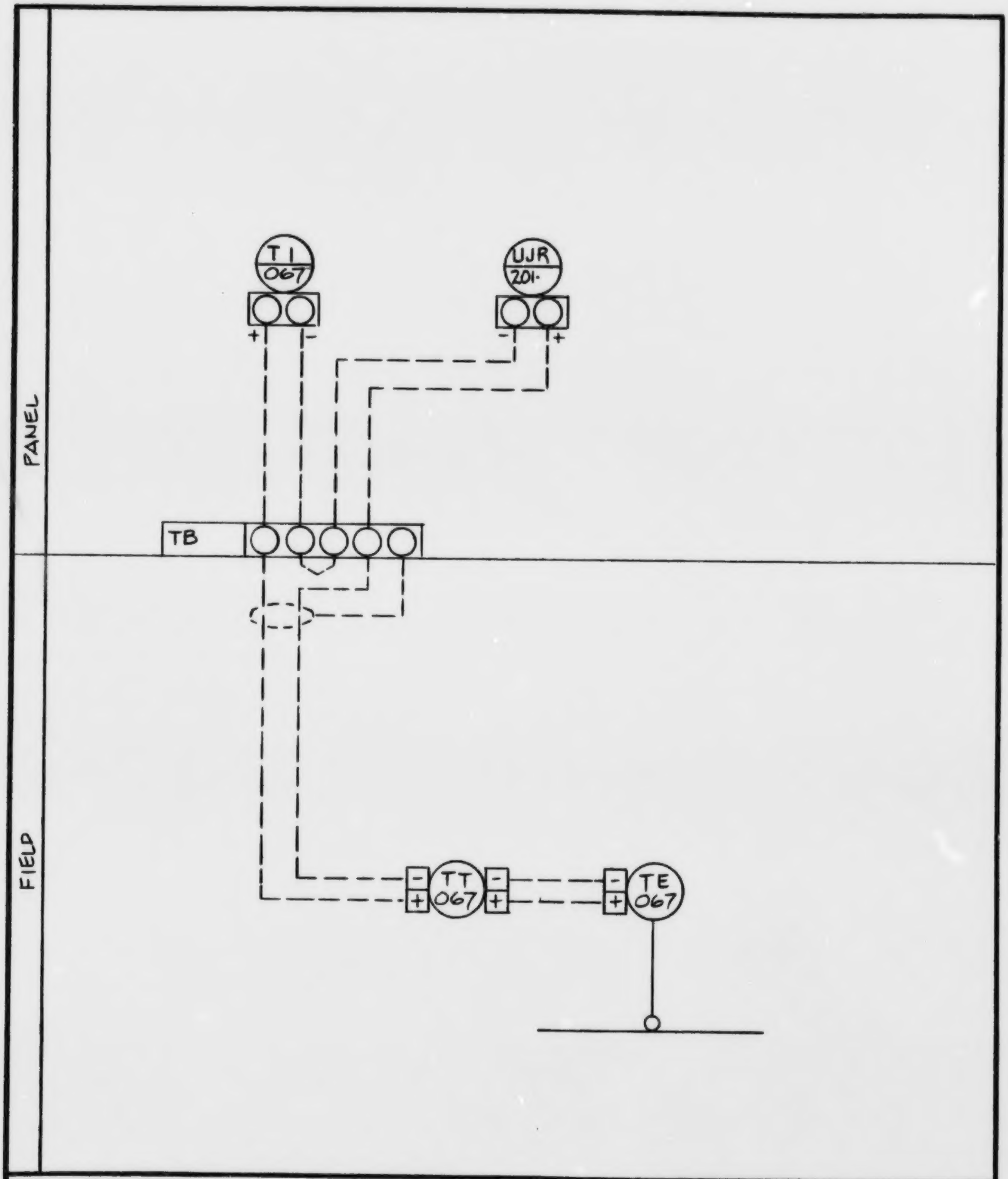
DWN	CHK	APP	DATE	RV
AF				0

FLUE GAS COOLER OUTLET
- PRESSURE

LOOP DIAGRAM

A	**0243**	8301	066	0


PANEL
FIELD
TI
067
UJR
201-
+
-
-
+
TB
TT
067
TE
067
-
+
-
+
-
+

ENERGY, MINES & RESOURCES CANADA

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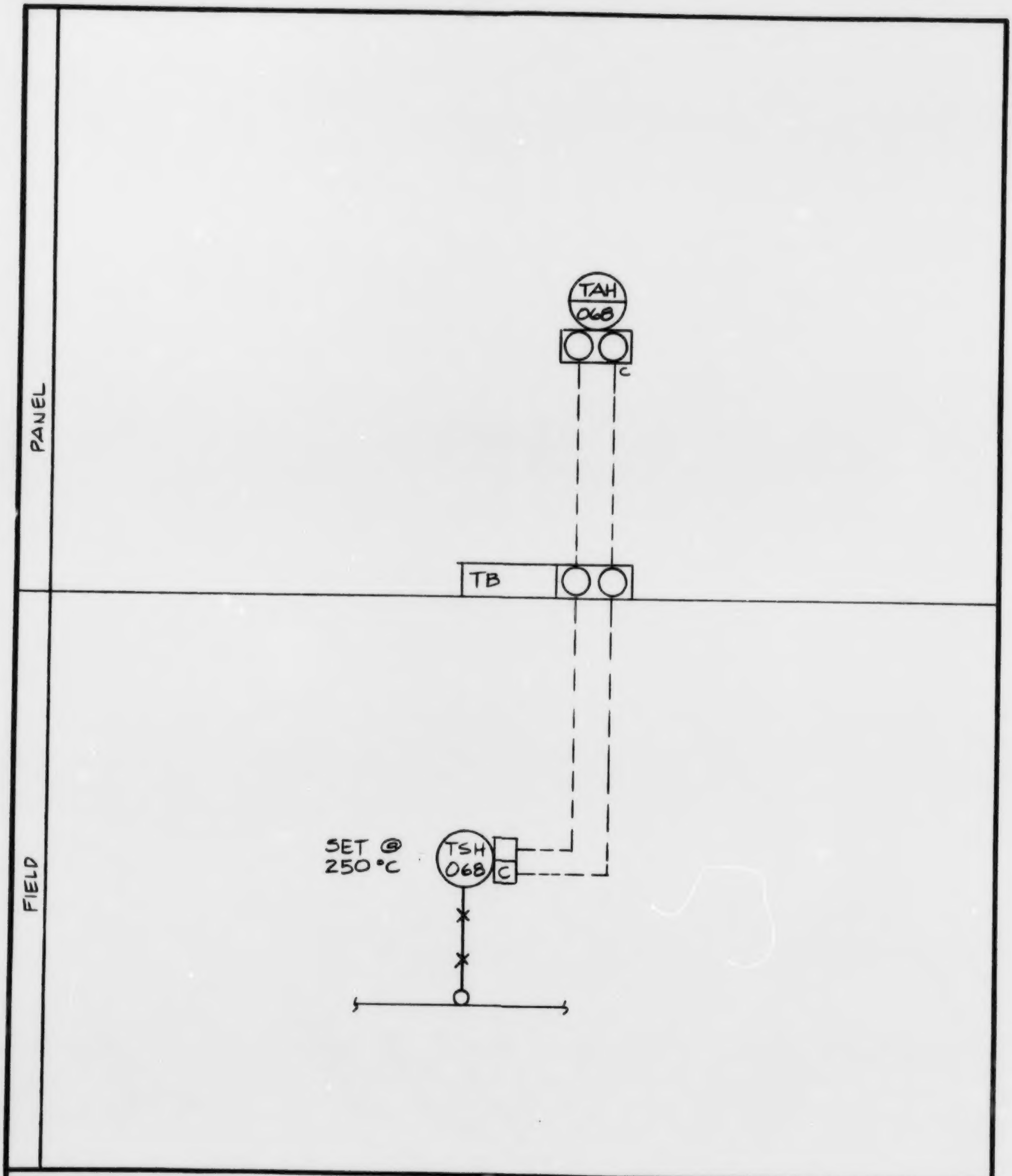
Intercontinental Engineering Ltd.

DWN	CHK	APP	DATE	RV
AF				0

FLUE GAS COOLER GAS OUTLET
- TEMPERATURE

LOOP DIAGRAM

A **0243** 8301 067 0


PANEL
FIELD
TAH
068
C
TB
SET @
250 °C
TSH
068
C

ENERGY, MINES & RESOURCES
CANADA

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RESEARCH FACILITY

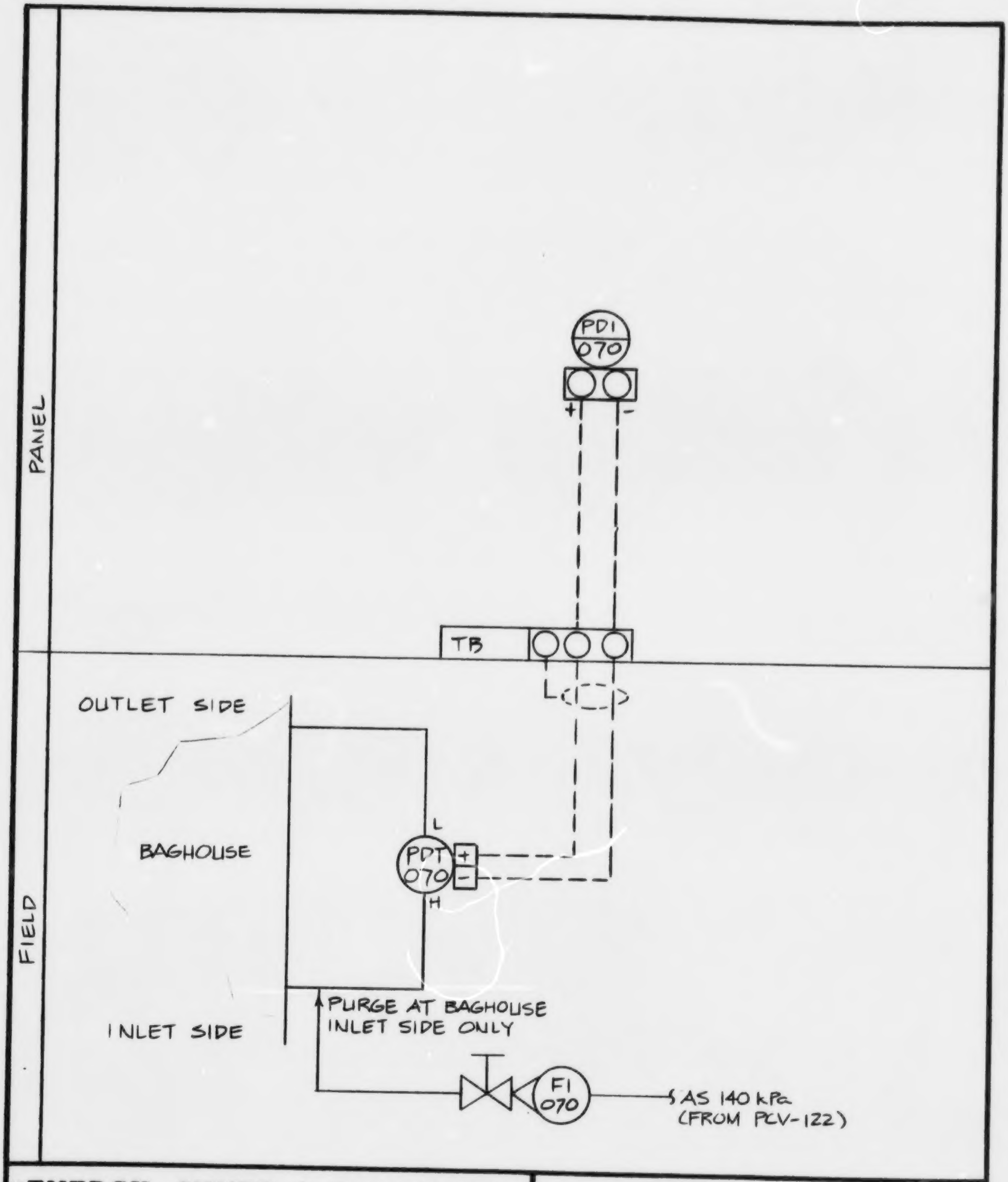
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

FLUE GAS COOLER GAS OUTLET
- TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	068	0


PANEL
FIELD
PDI
070
+
-
TB
L
OUTLET SIDE
BAGHOUSE
L
PDT
070
+
-
H
INLET SIDE
PURGE AT BAGHOUSE
INLET SIDE ONLY
FI
070
AS 140 kPa
(FROM PCV-122)

ENERGY, MINES & RESOURCES
CANADA

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RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

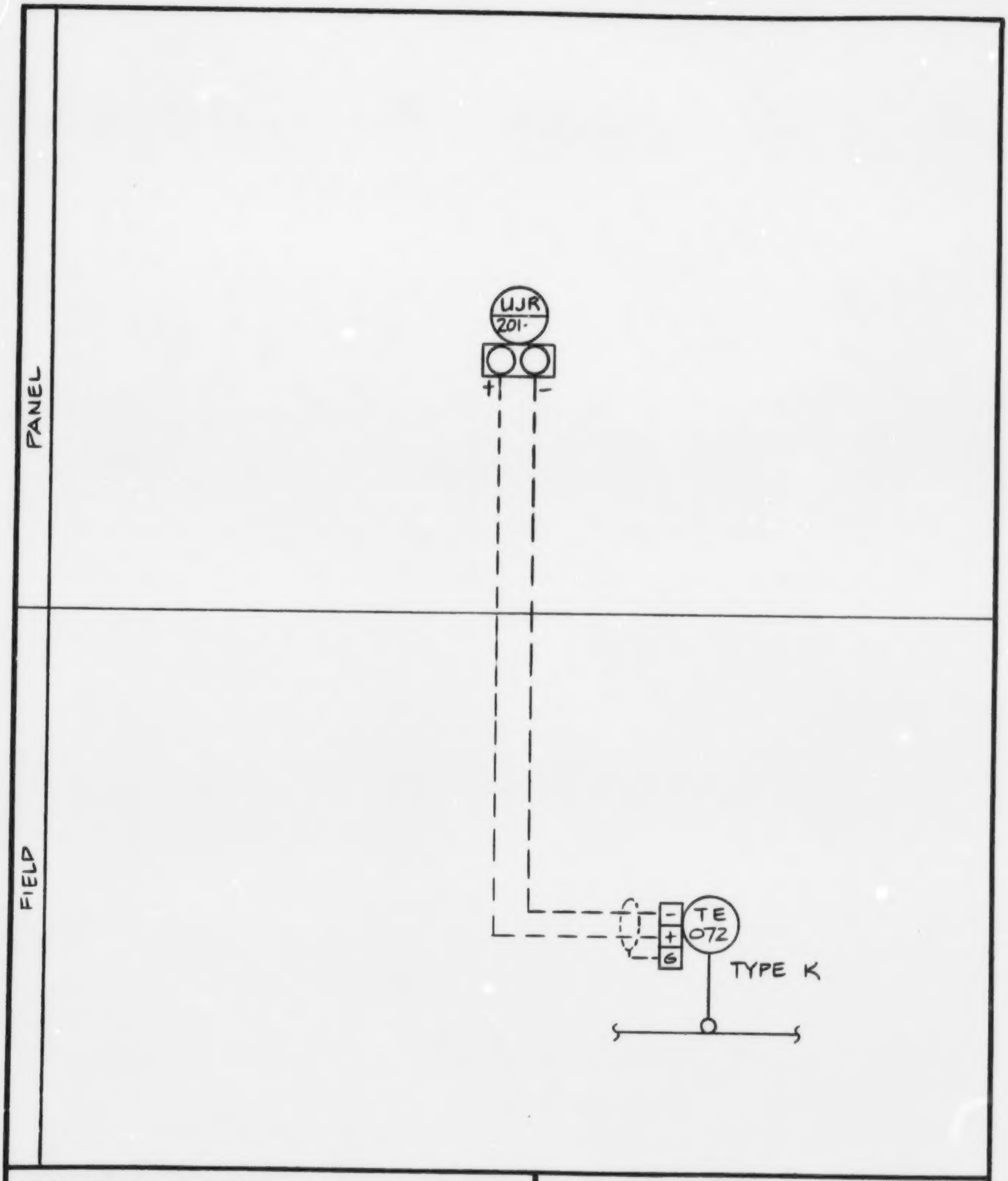
DWN	CHK	APP	DATE	RV
AF				0

BAGHOUSE FLUE GAS
- DIFFERENTIAL PRESSURE

97

LOOP DIAGRAM

A	**0243**	8301	070	0


PANEL
UJR
201
+
-
FIELD
-
+
G
TE
072
TYPE K

ENERGY, MINES & RESOURCES
CANADA

A R F B C
RESEARCH FACILITY

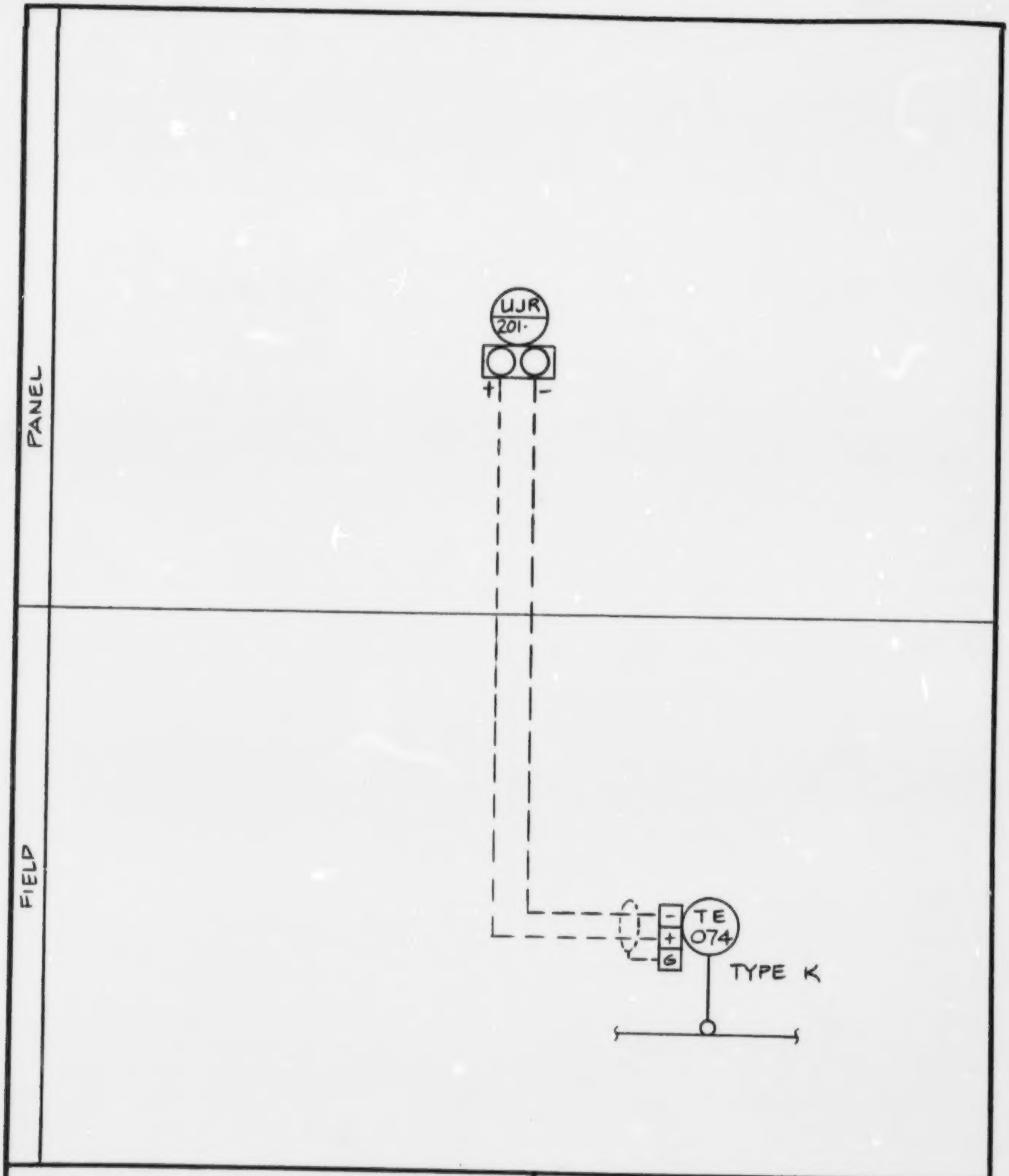
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

I.D. FAN FLUE GAS INLET
- TEMPERATURE

LOOP DIAGRAM

A 0243 8301 072 0


PANEL
FIELD
UJR
201-
+
-
TE
074
-
+
G
TYPE K

ENERGY, MINES & RESOURCES
CANADA

A R F B C
RESEARCH FACILITY

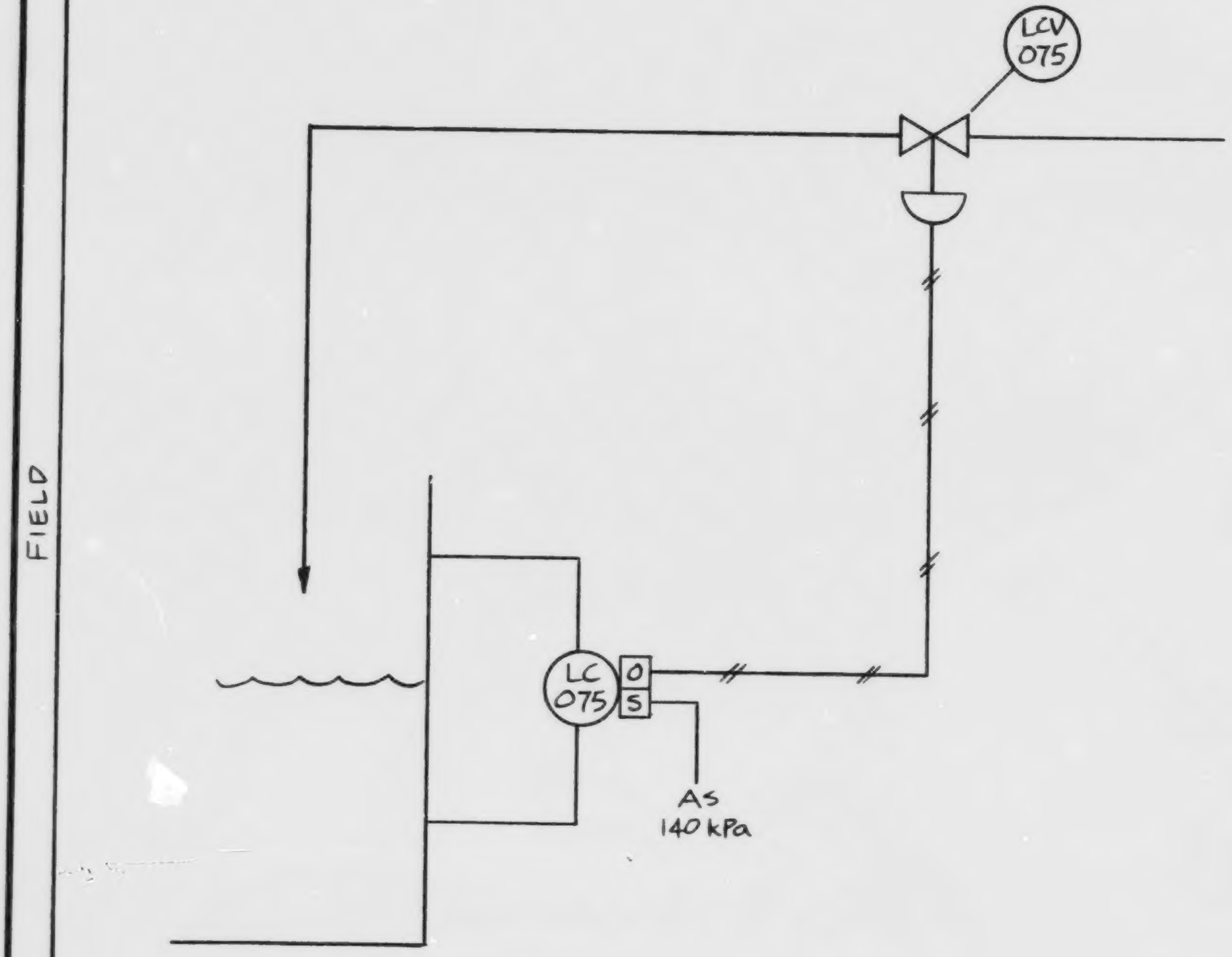
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER REMOTE SUMP
MAKE UP WATER - TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	074	0


FIELD
LCV
075
LC
075
O
S
AS
140 kPa

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

integ
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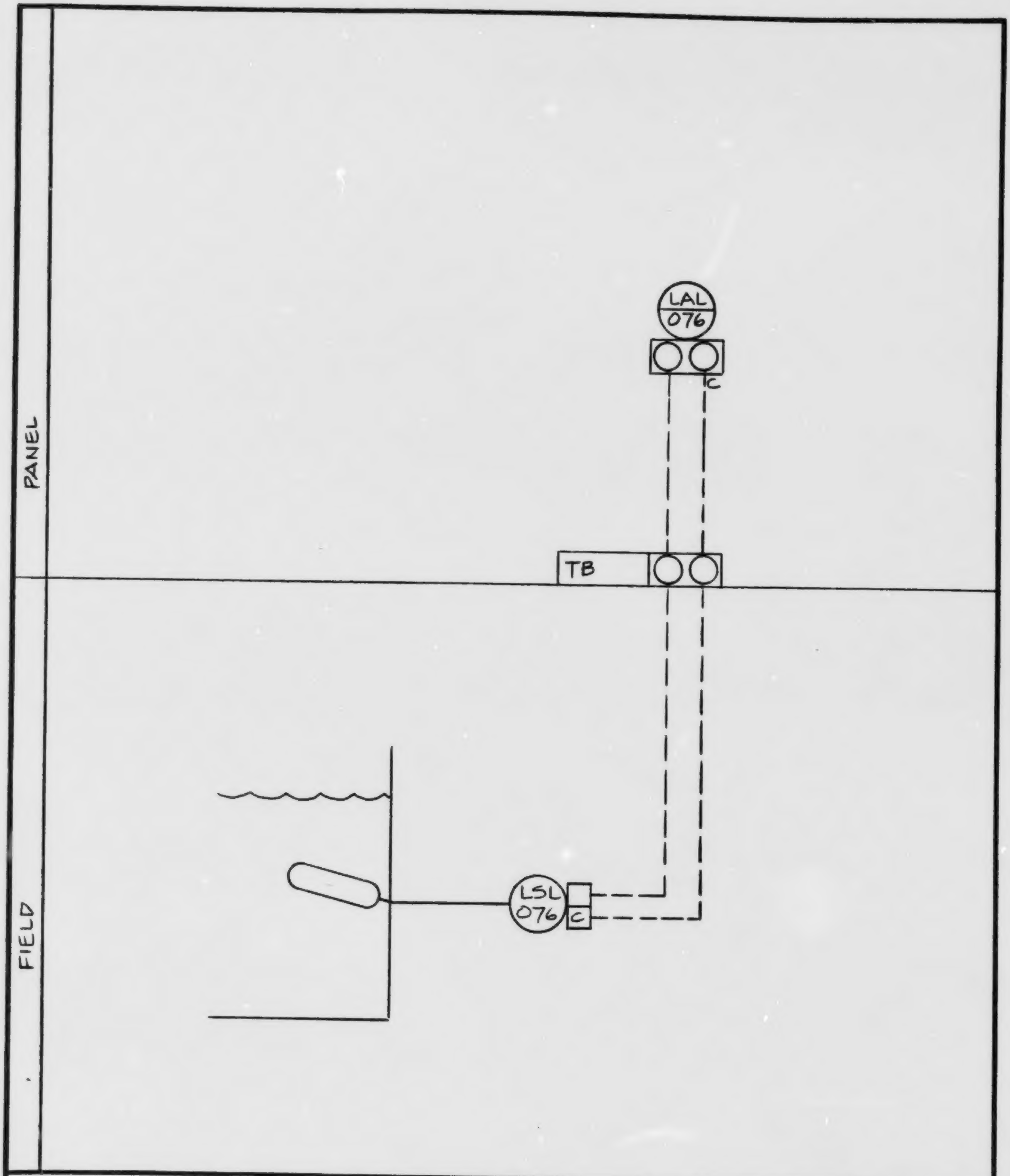
DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER REMOTE SUMP
- LEVEL

LOOP DIAGRAM

A	**0243**	8301	075	0


PANEL
FIELD
LAL
076
C
TB
LSL
076
C

ENERGY, MINES & RESOURCES
CANADA

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RESEARCH FACILITY

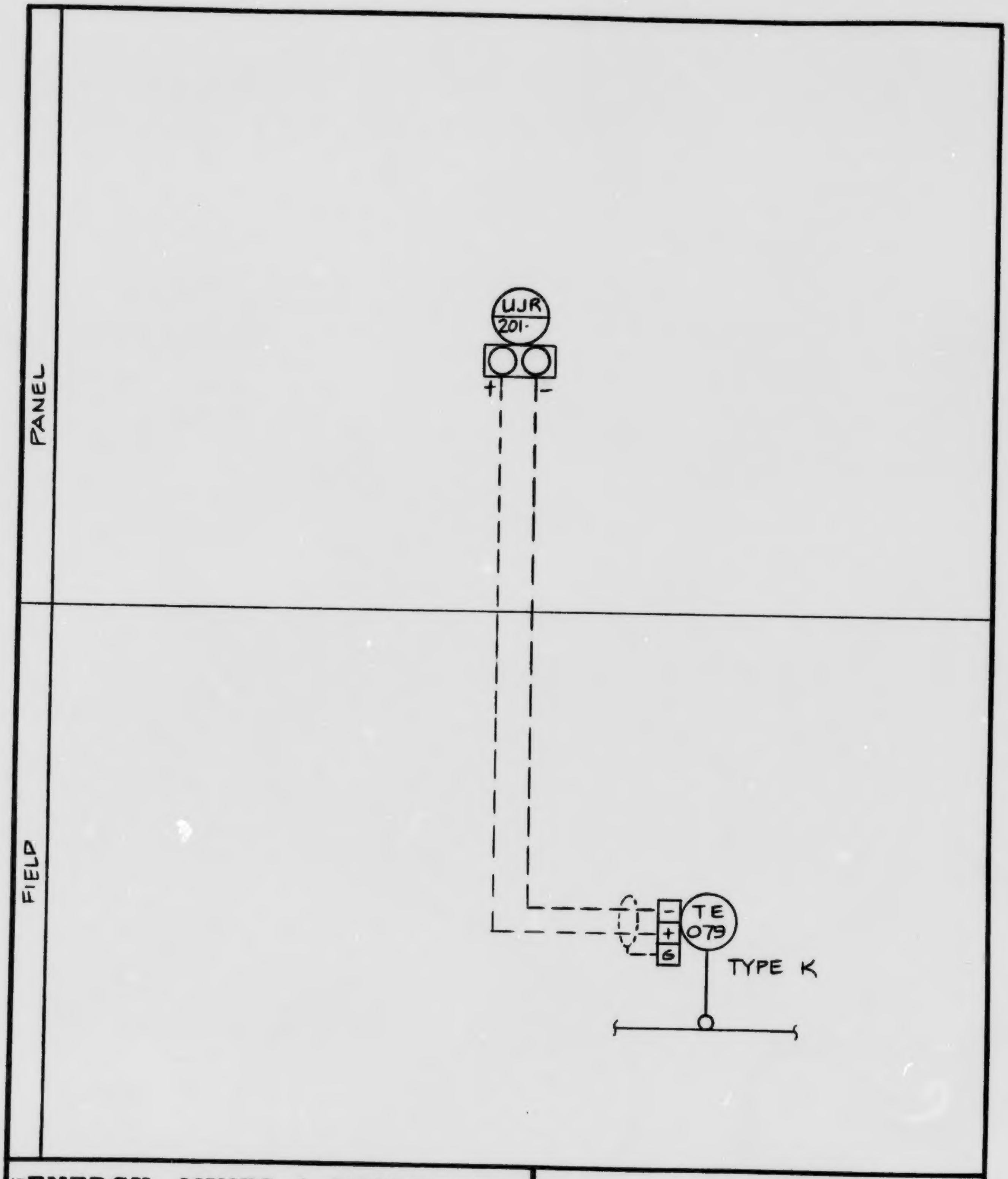
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER REMOTE SUMP
- LEVEL

LOOP DIAGRAM

A	**0243**	8301	076	0


PANEL
FIELD
UJR
201-
+
-
-
+
G
TE
079
TYPE K

ENERGY, MINES & RESOURCES CANADA

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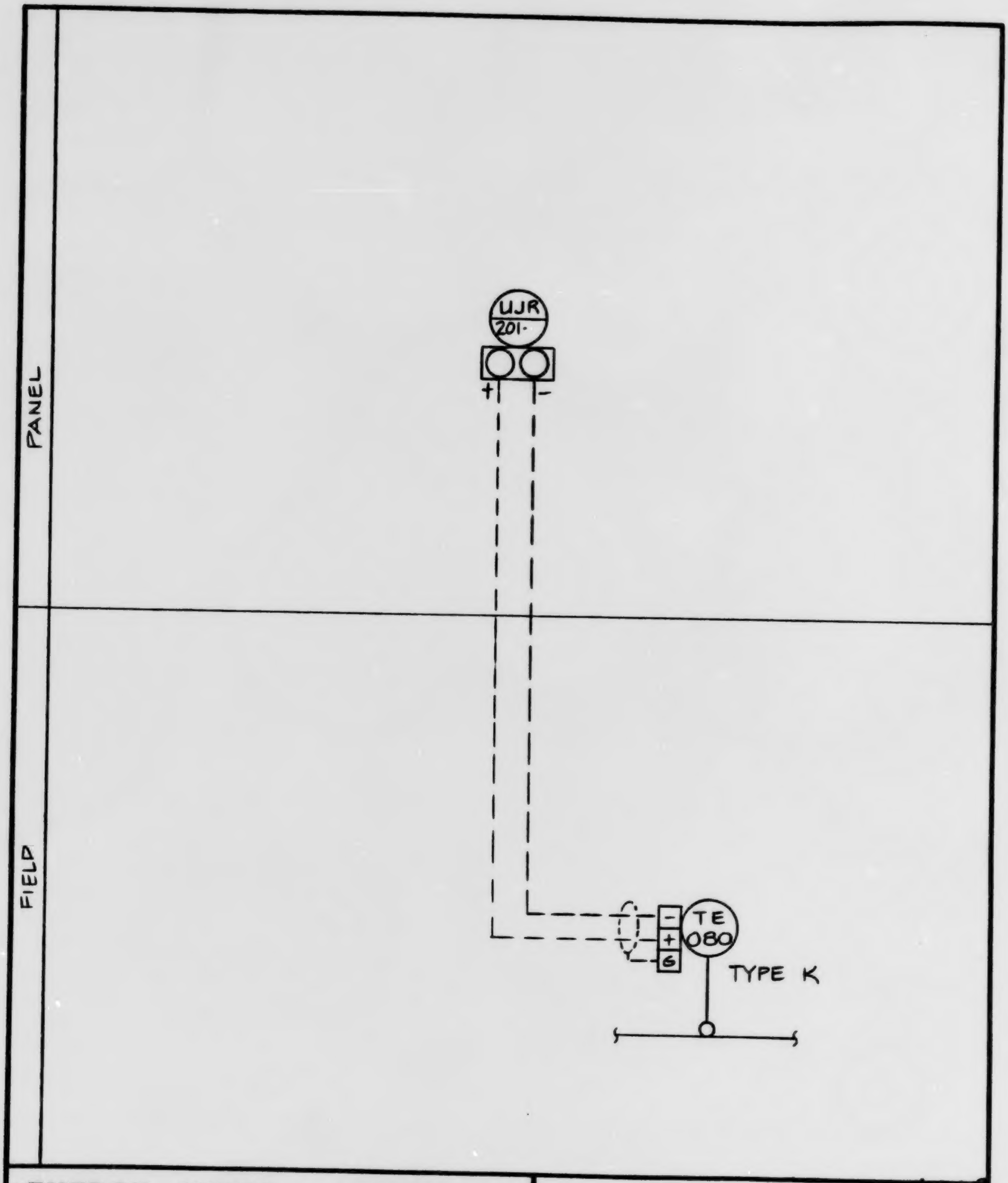
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER WATER AT HEAT EXCHANGER INLET - TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	079	0


PANEL
FIELD
UJR
201-
+
-
-
+
G
TE
080
TYPE K

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

integ
Intercontinental Engineering Ltd

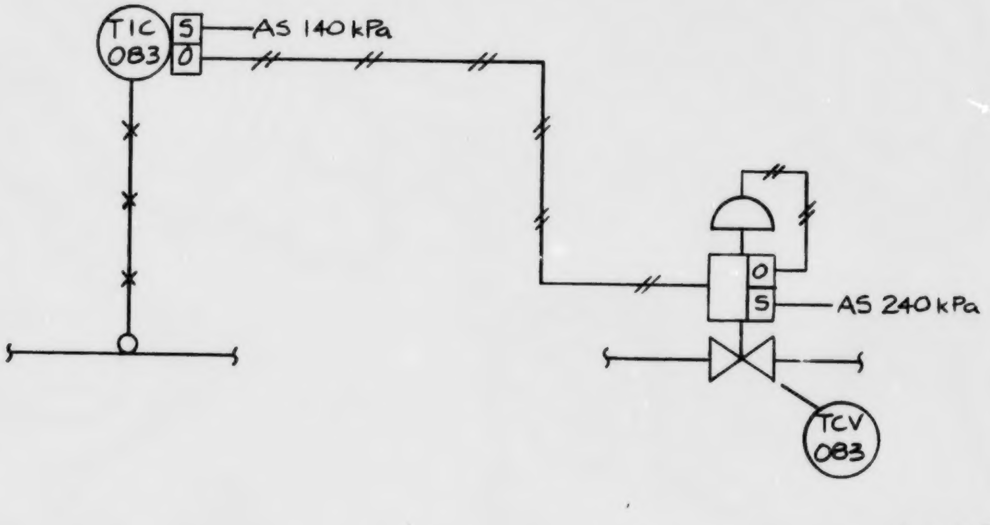
DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER WATER AT HEAT EXCHANGER OUTLET - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	080	0

FIELD


TIC
083
S
O
AS 140 kPa
O
S
AS 240 kPa
TCV
083

ENERGY, MINES & RESOURCES CANADA

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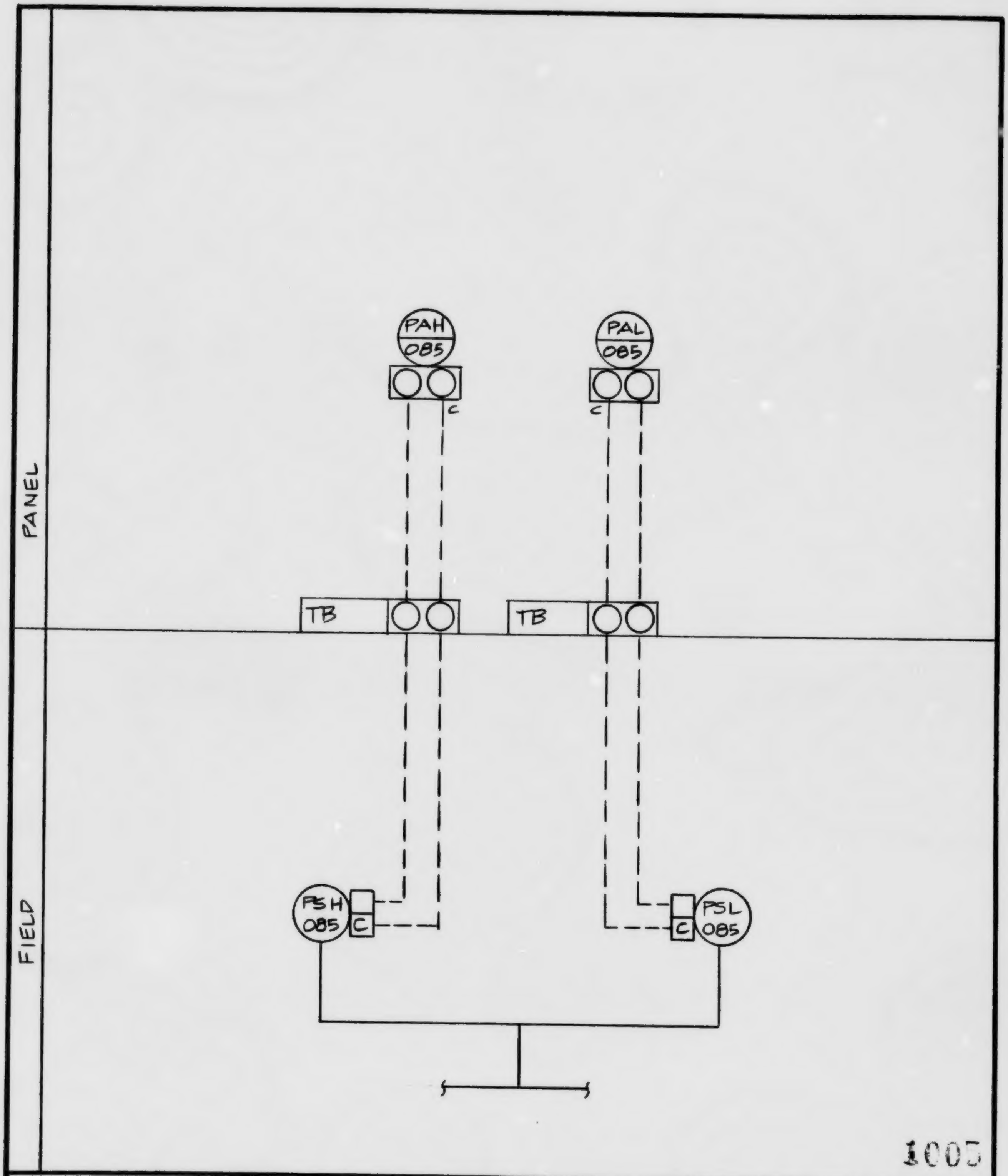
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER HEADER
- TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	083	0


PANEL
FIELD
PAH 085
PAL 085
c
c
TB
TB
PSH 085
C
PSL 085
C

1003

ENERGY, MINES & RESOURCES CANADA

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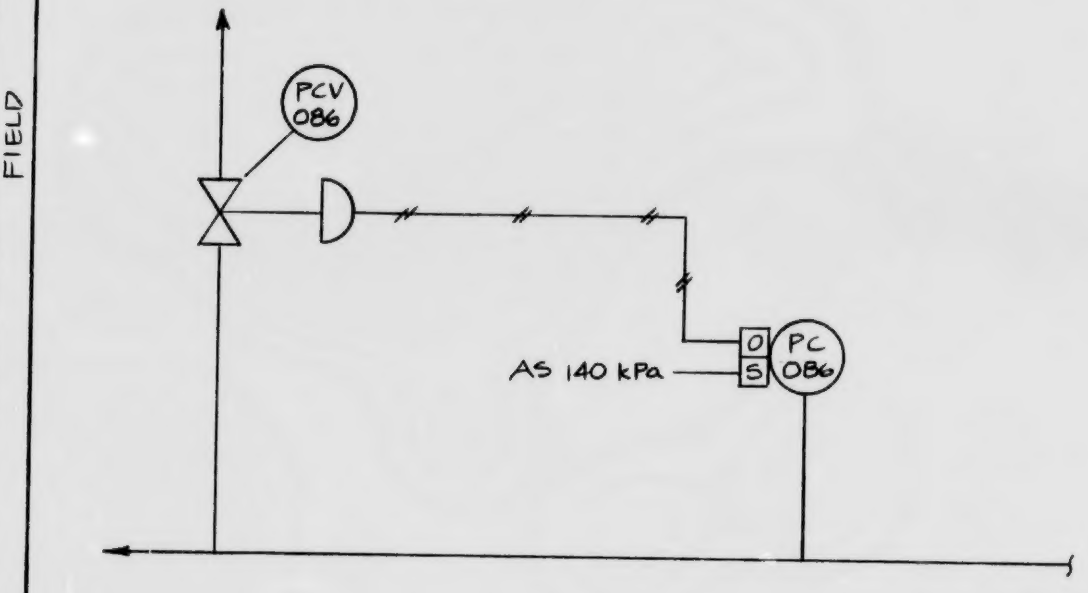
Intercontinental Engineering Ltd.

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER HEADER
– PRESSURE

LOOP DIAGRAM

A	**0243**	8301	085	0


FIELD
PCV
086
O
S
PC
086
AS 140 kPa

100

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

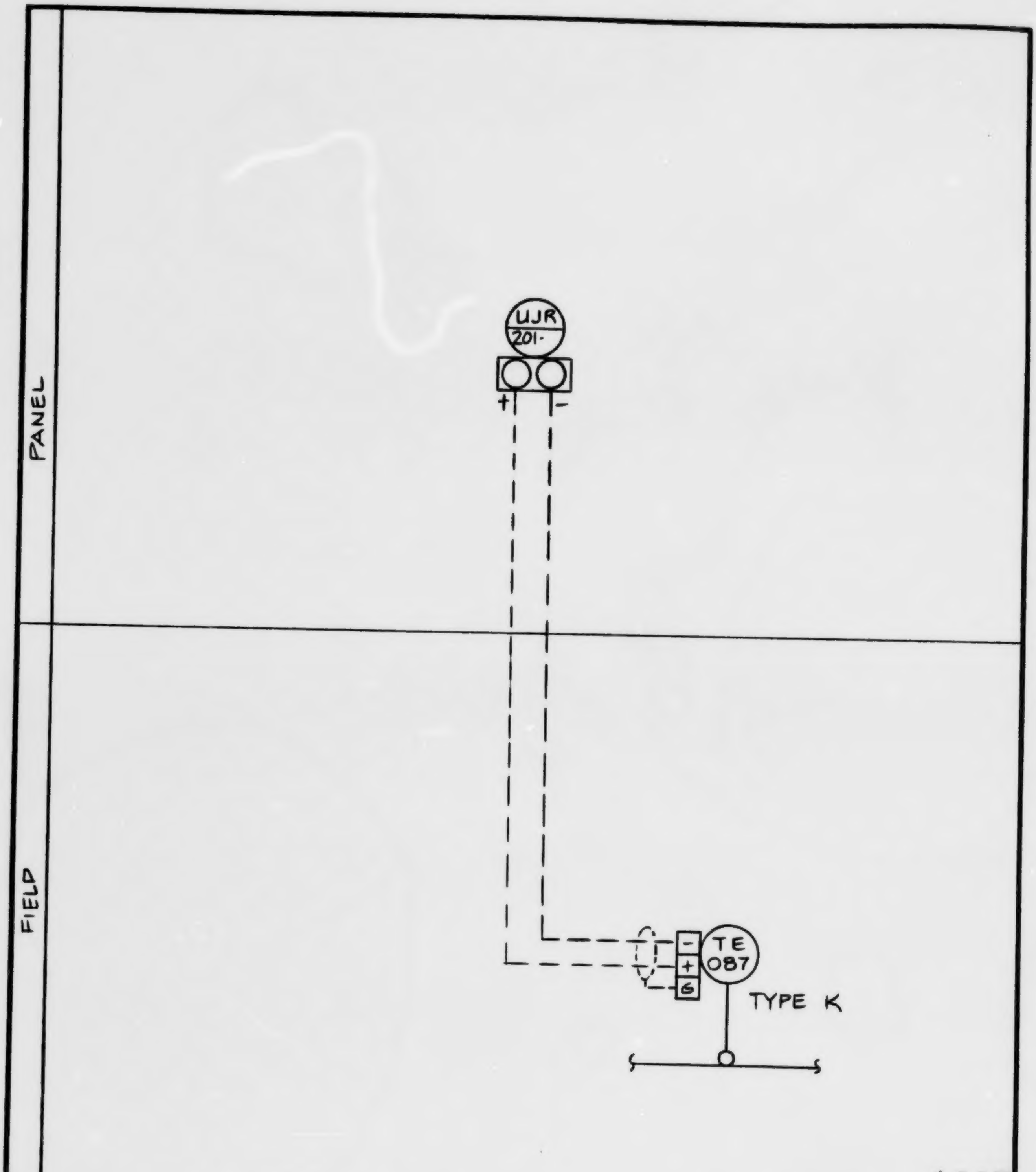
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER HEADER - PRESSURE

LOOP DIAGRAM

A	0243	8301	086	0


PANEL
FIELD
UJR
201-
+
-
TE
087
-
+
G
TYPE K

1007

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

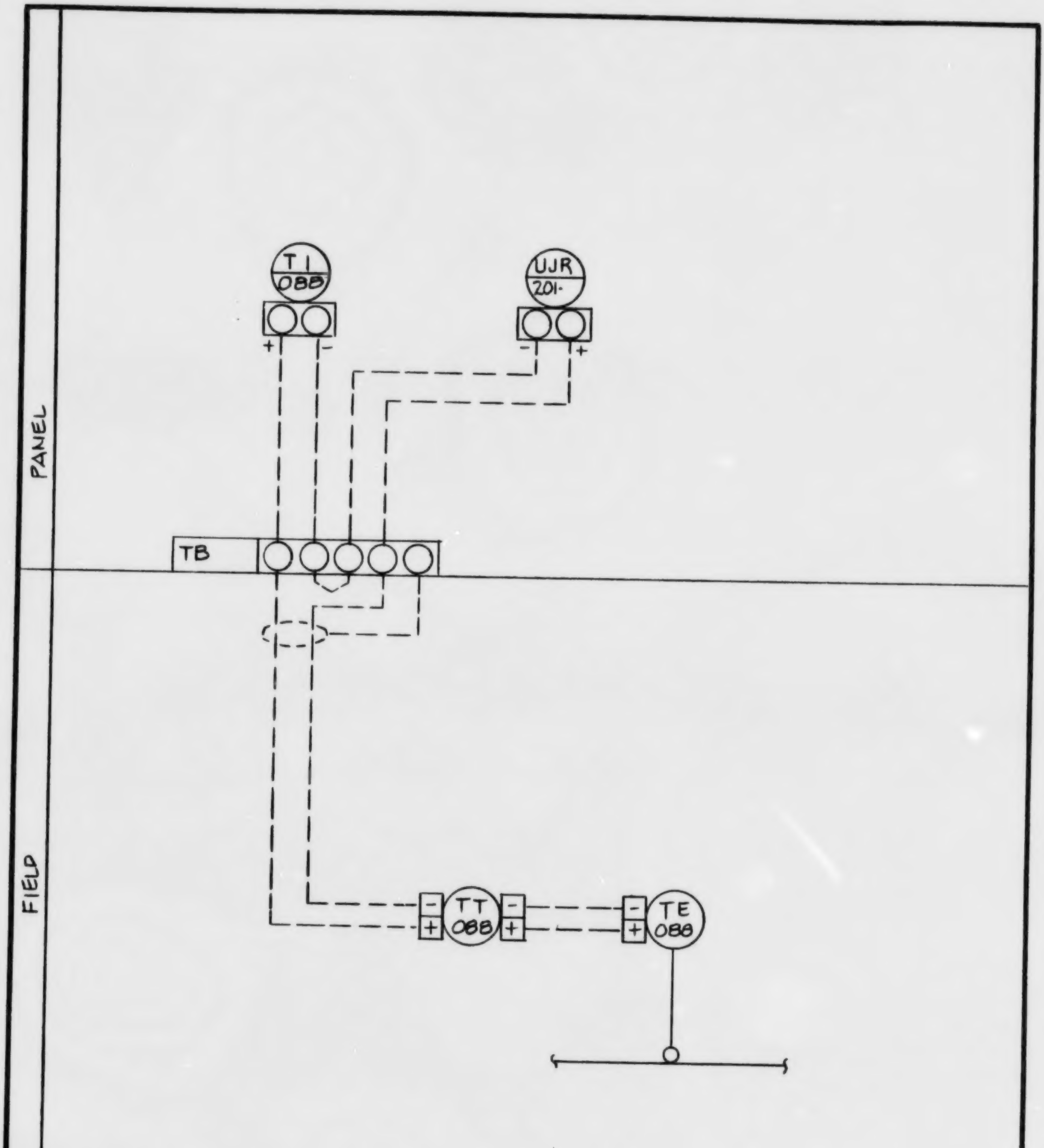
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER AT HEAT EXCHANGER INLET - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	087	0


PANEL
FIELD
TI
088
+
-
UJR
201-
-
+
TB
-
+
TT
088
-
+
-
+
TE
088

1008

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

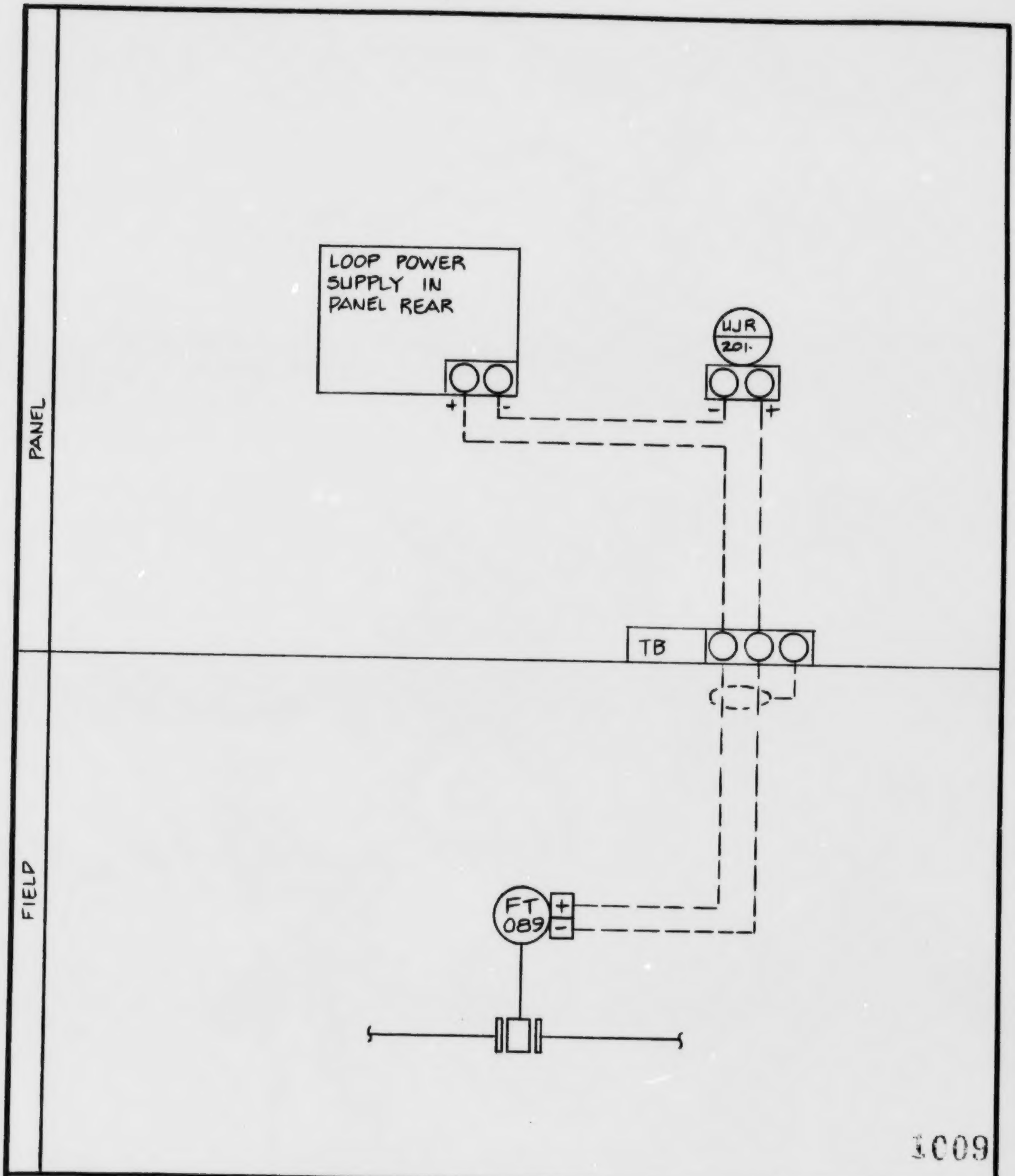
integ
Intercontinental Engineering Ltd.

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER AT HEAT EXCHANGER OUTLET - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	088	0


PANEL
FIELD
LOOP POWER SUPPLY IN PANEL REAR
+
-
UJR
201
-
+
TB
FT
089
+
-

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

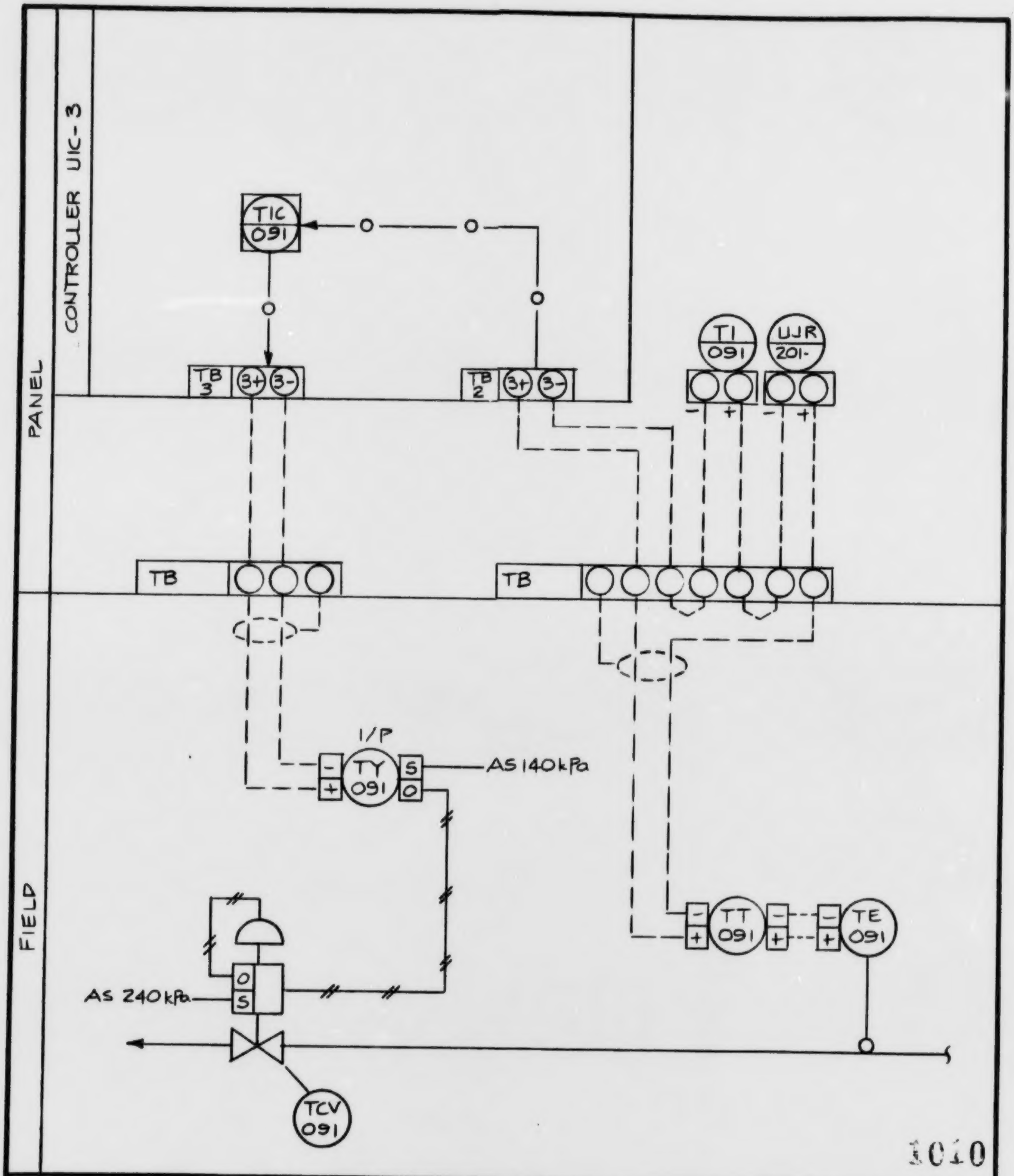
Intercontinental Engineering Ltd.

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER TO FLUE GAS COOLER - FLOW

LOOP DIAGRAM

A	**0243**	8301	089	0


PANEL
CONTROLLER UIC-3
TIC 091
TB 3
3+
3-
TB 2
3+
3-
TI 091
UJR 201-
-
+
-
+
TB
TB
I/P
TY 091
-
+
S
O
AS 140 kPa
AS 240 kPa
O
S
FIELD
TT 091
-
+
-
+
-
+
TE 091
TCV 091

1010

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

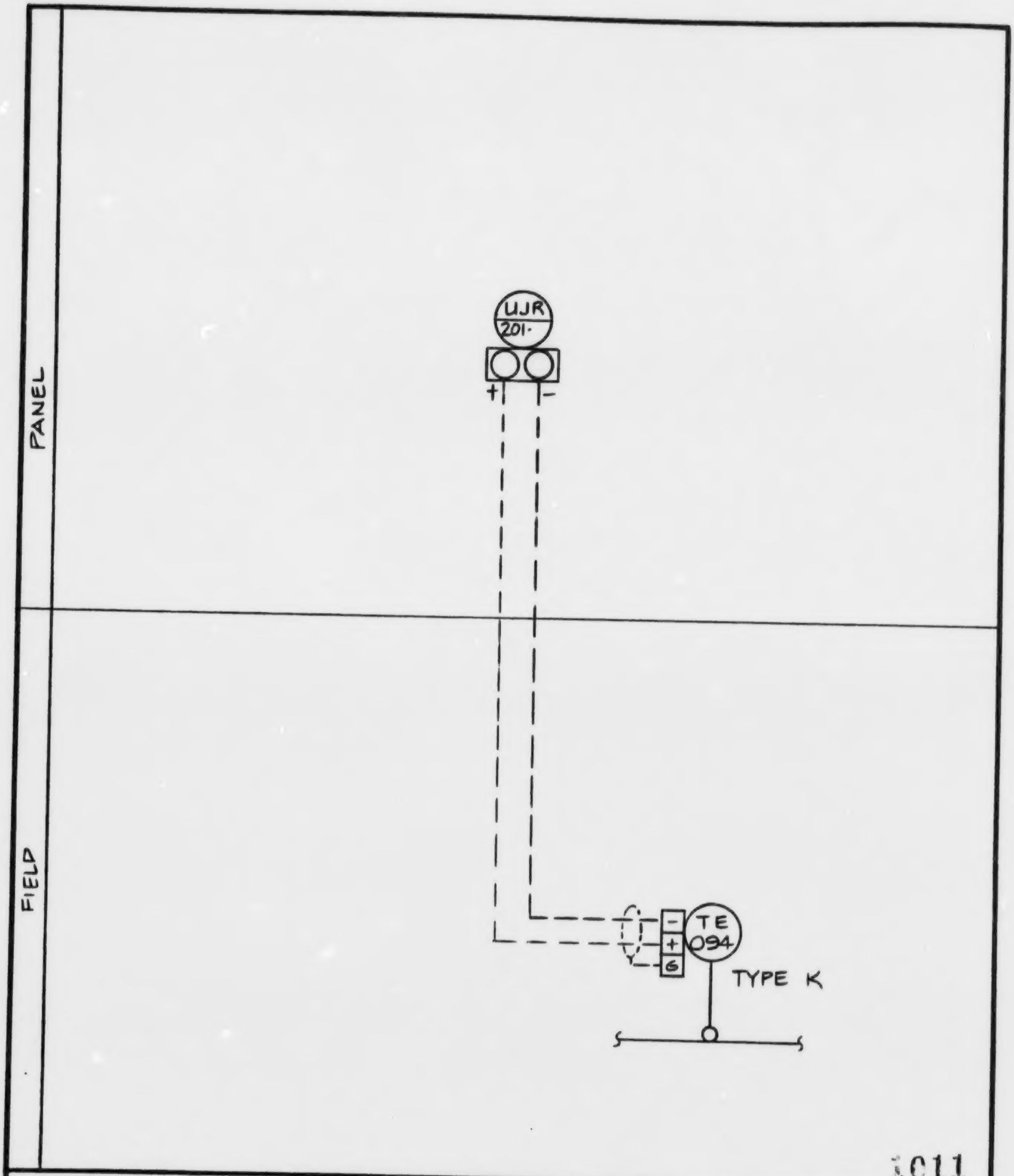
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER AT FLUE GAS COOLER OUTLET - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	091	0


PANEL
UJR
201-
+
-
FIELD
-
+
G
TE
094
TYPE K

3011

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

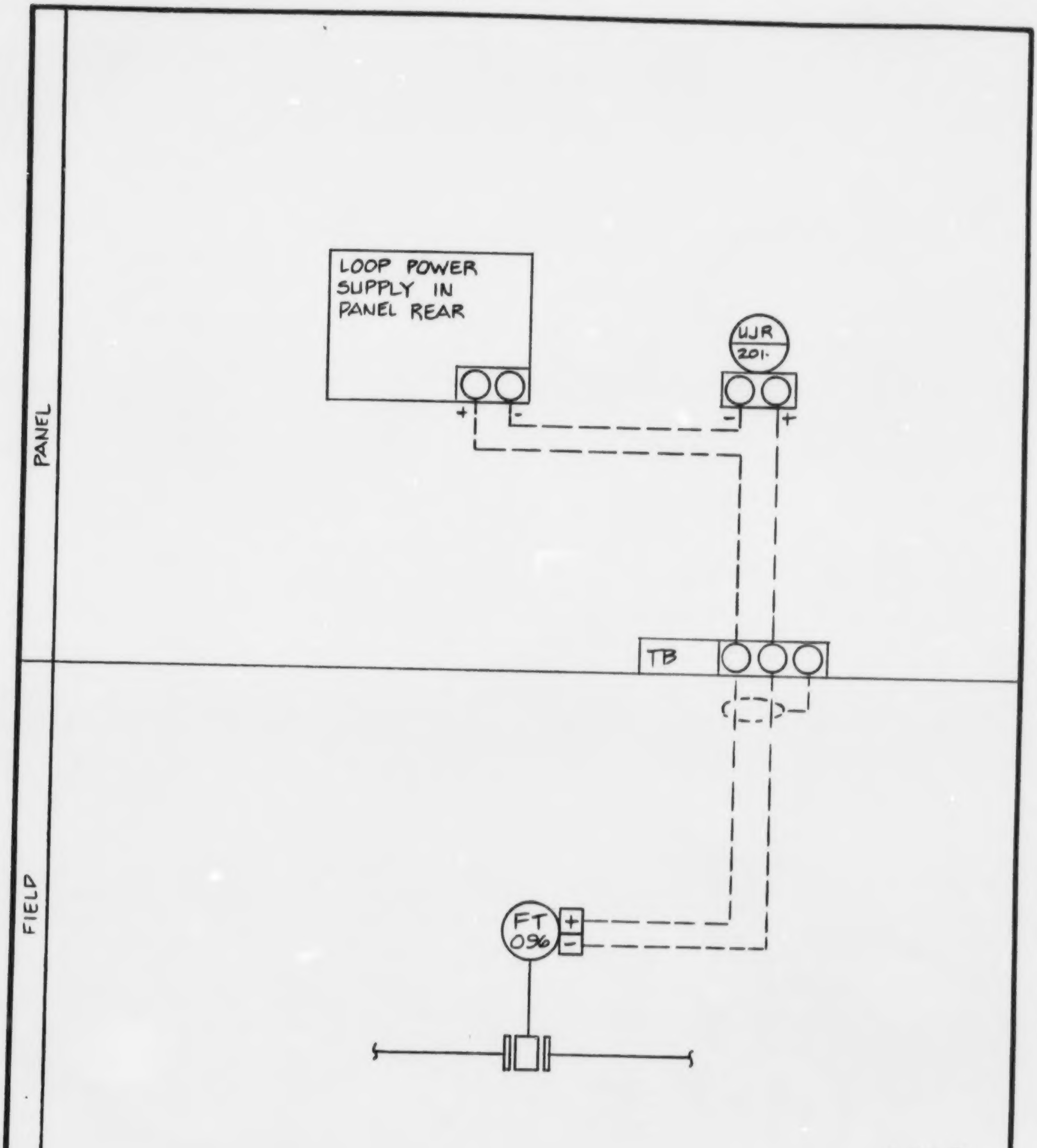
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER AT BED DRAIN COOLER OUTLET - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	094	0


PANEL
FIELD
LOOP POWER SUPPLY IN PANEL REAR
+
-
UJR
201
-
+
TB
FT
096
+
-

1C12

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

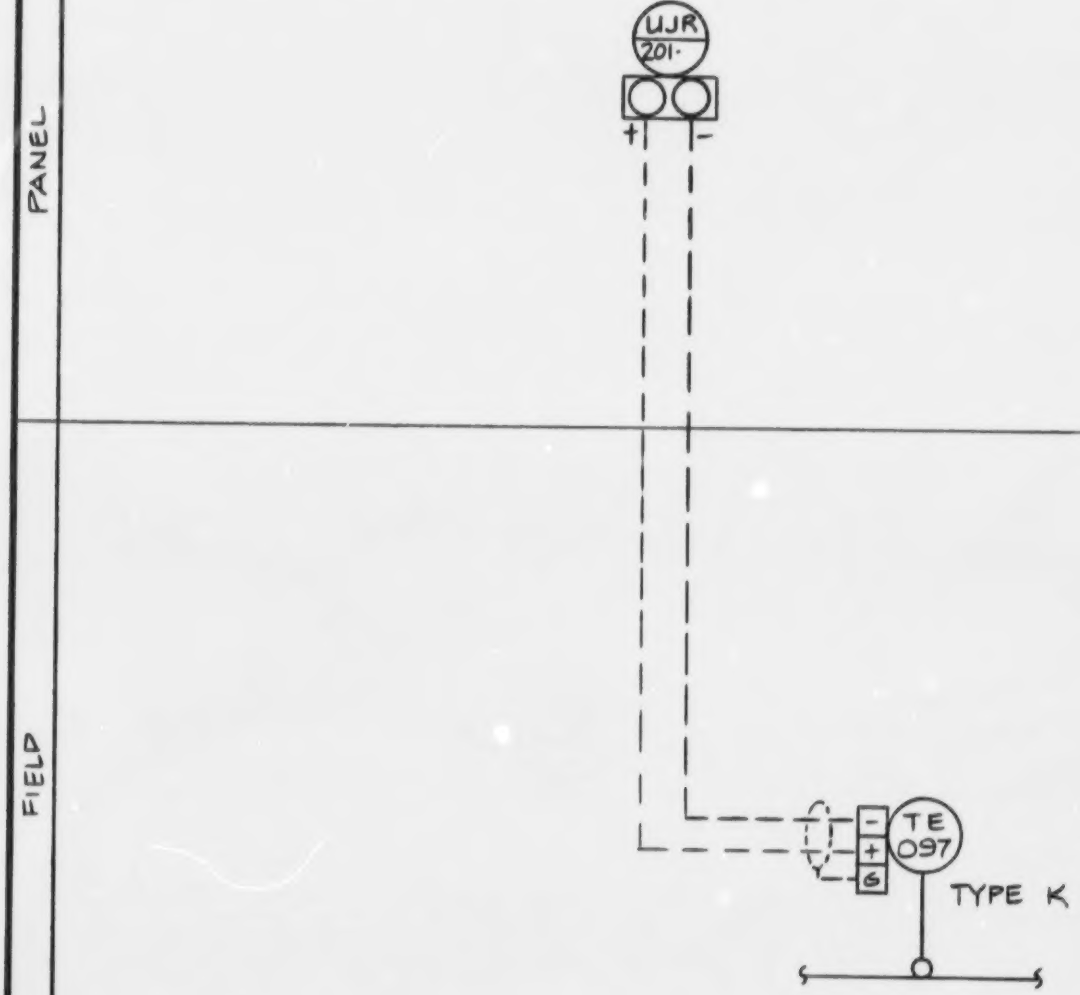
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				O

PLANT COOLING WATER TO BAYONET TUBE NO. 1 – FLOW

LOOP DIAGRAM

A	**0243**	8301	096	0


PANEL
FIELD
UJR
201
+
-
-
+
G
TE
097
TYPE K

3013

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

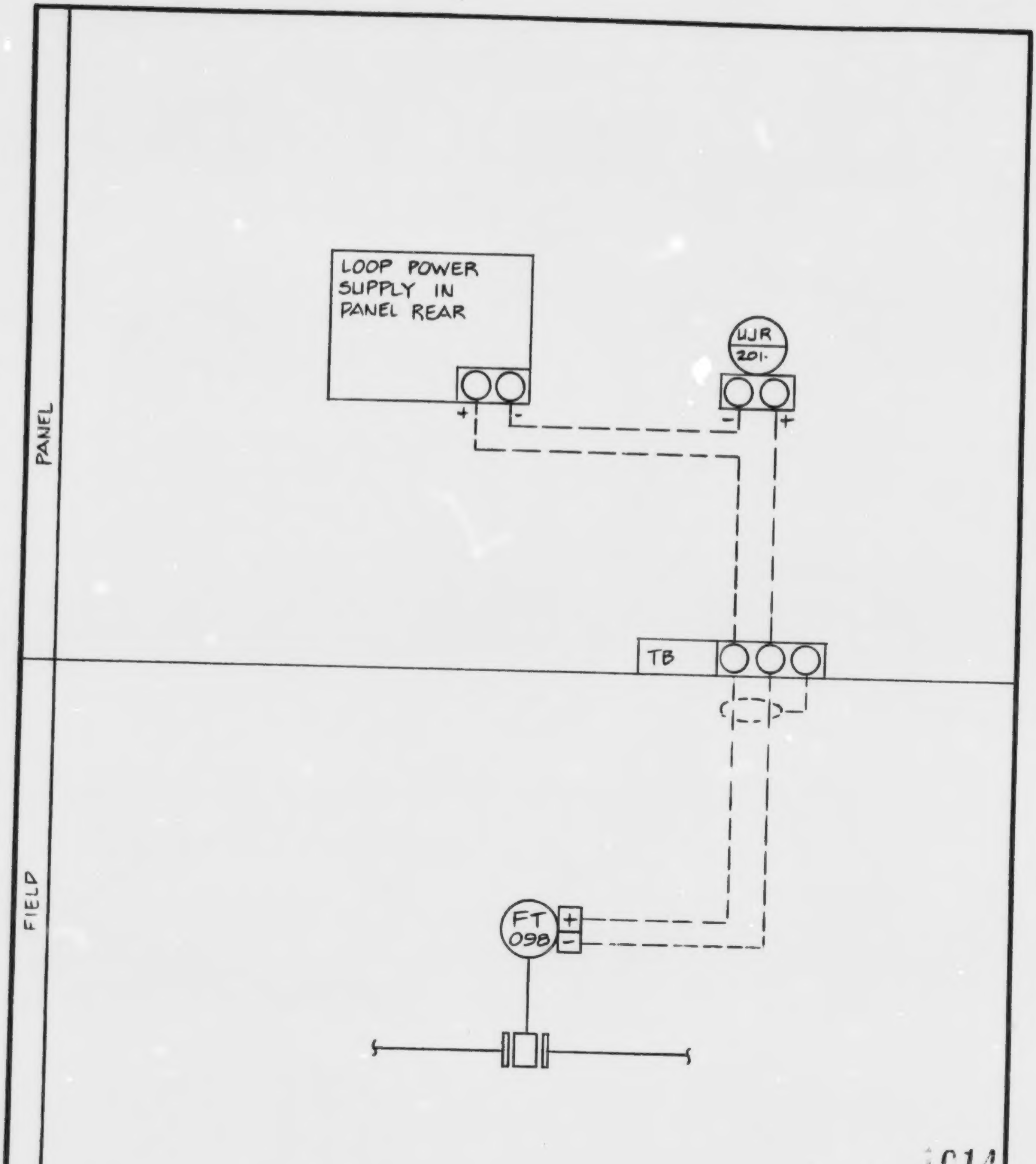
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER FROM BAYONET TUBE NO. 1 - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	097	0


PANEL
LOOP POWER SUPPLY IN PANEL REAR
+
-
UJR 201
-
+
TB
FIELD
FT 098
+
-

C14

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

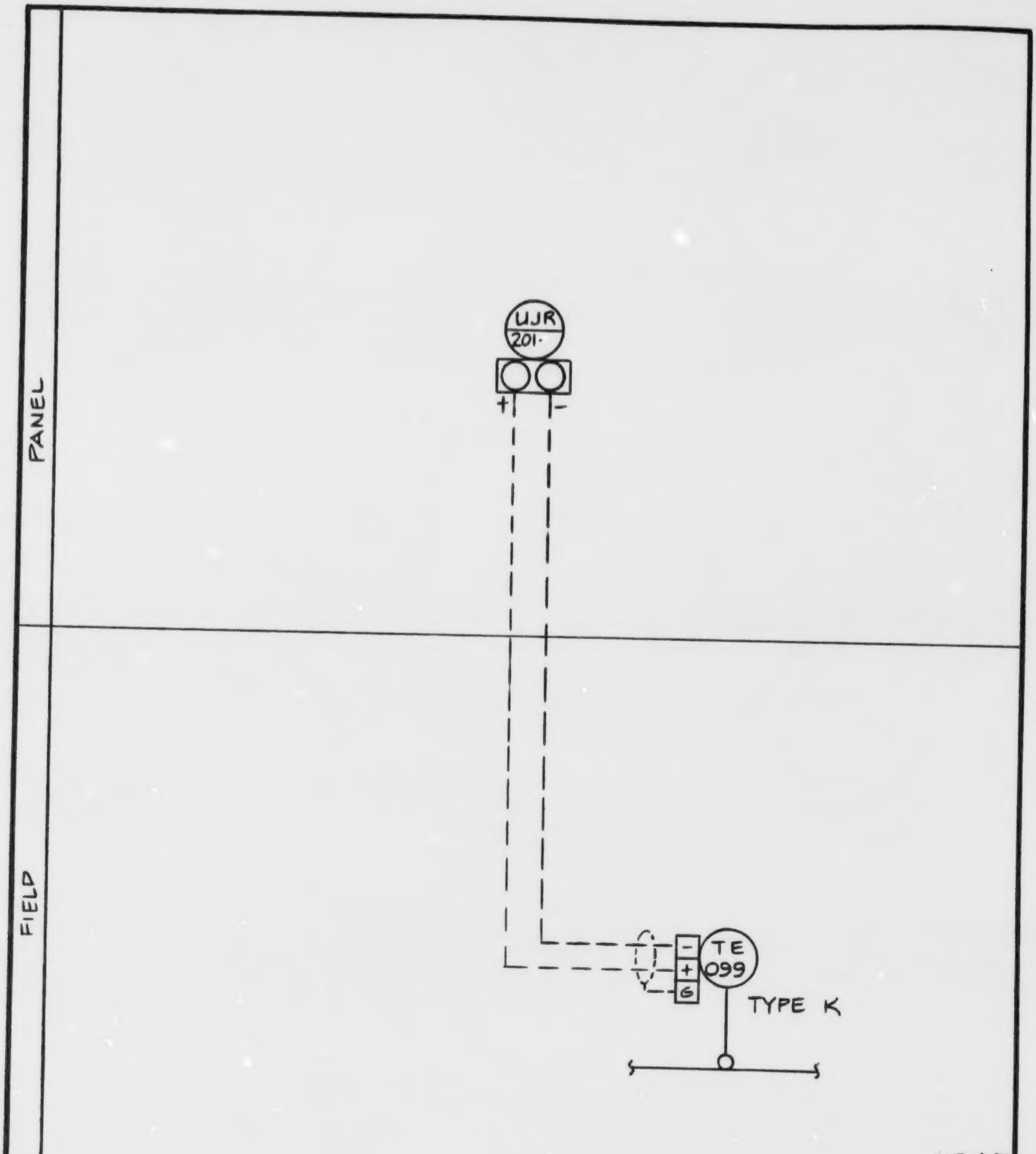
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER TO BAYONET TUBE NO. 2 - FLOW

LOOP DIAGRAM

A	**0243**	8301	098	0


PANEL
FIELD
UJR
201
+
-
-
+
G
TE
099
TYPE K

015

ENERGY, MINES & RESOURCES
CANADA

A R F B C
RESEARCH FACILITY

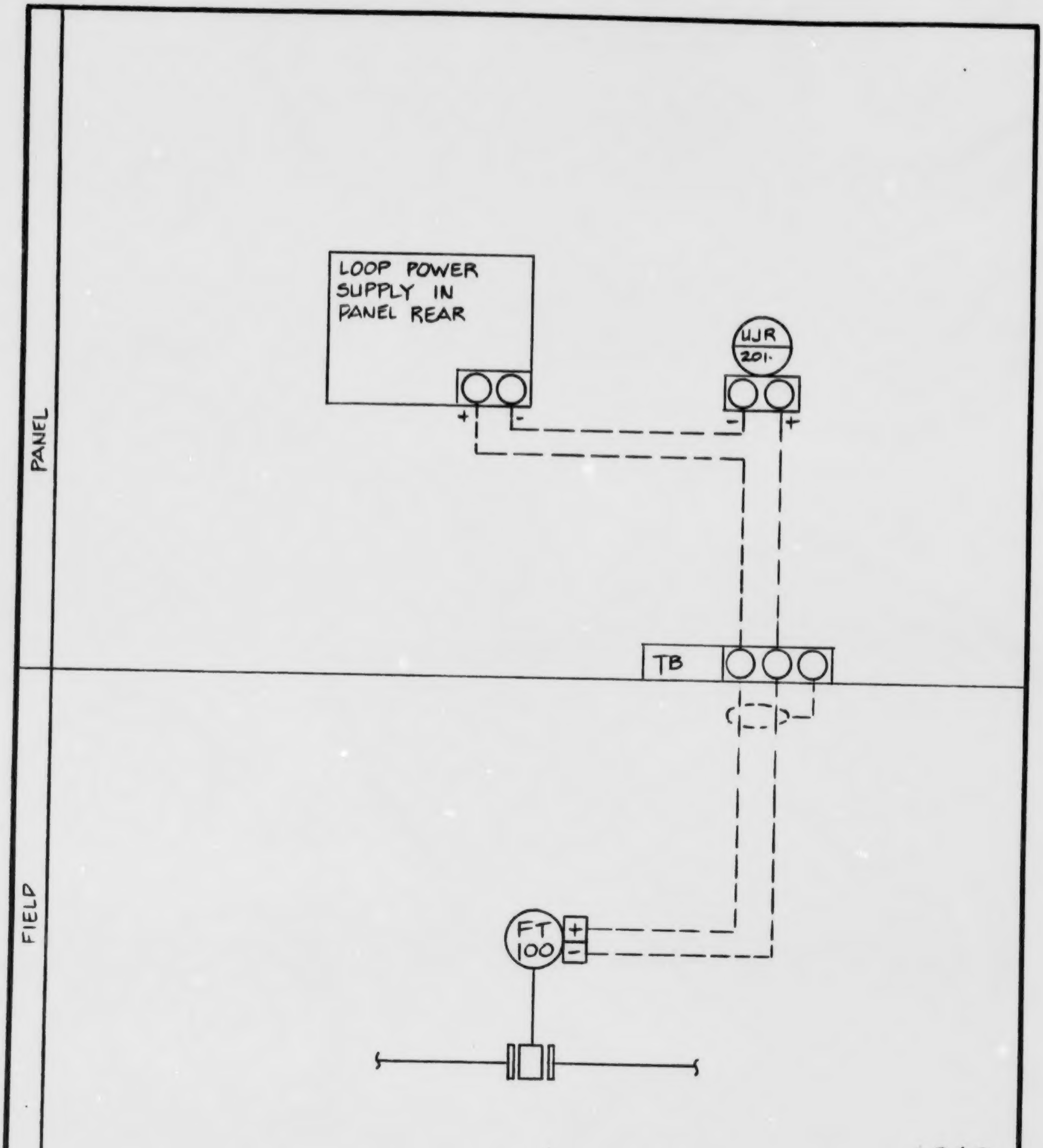
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER FROM
BAYONET TUBE NO. 2 - TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	099	0


LOOP POWER
SUPPLY IN
PANEL REAR
+
-
UJR
201
-
+
PANEL
TB
FIELD
FT
100
+
-

016

ENERGY, MINES & RESOURCES
CANADA

A R F B C
RESEARCH FACILITY

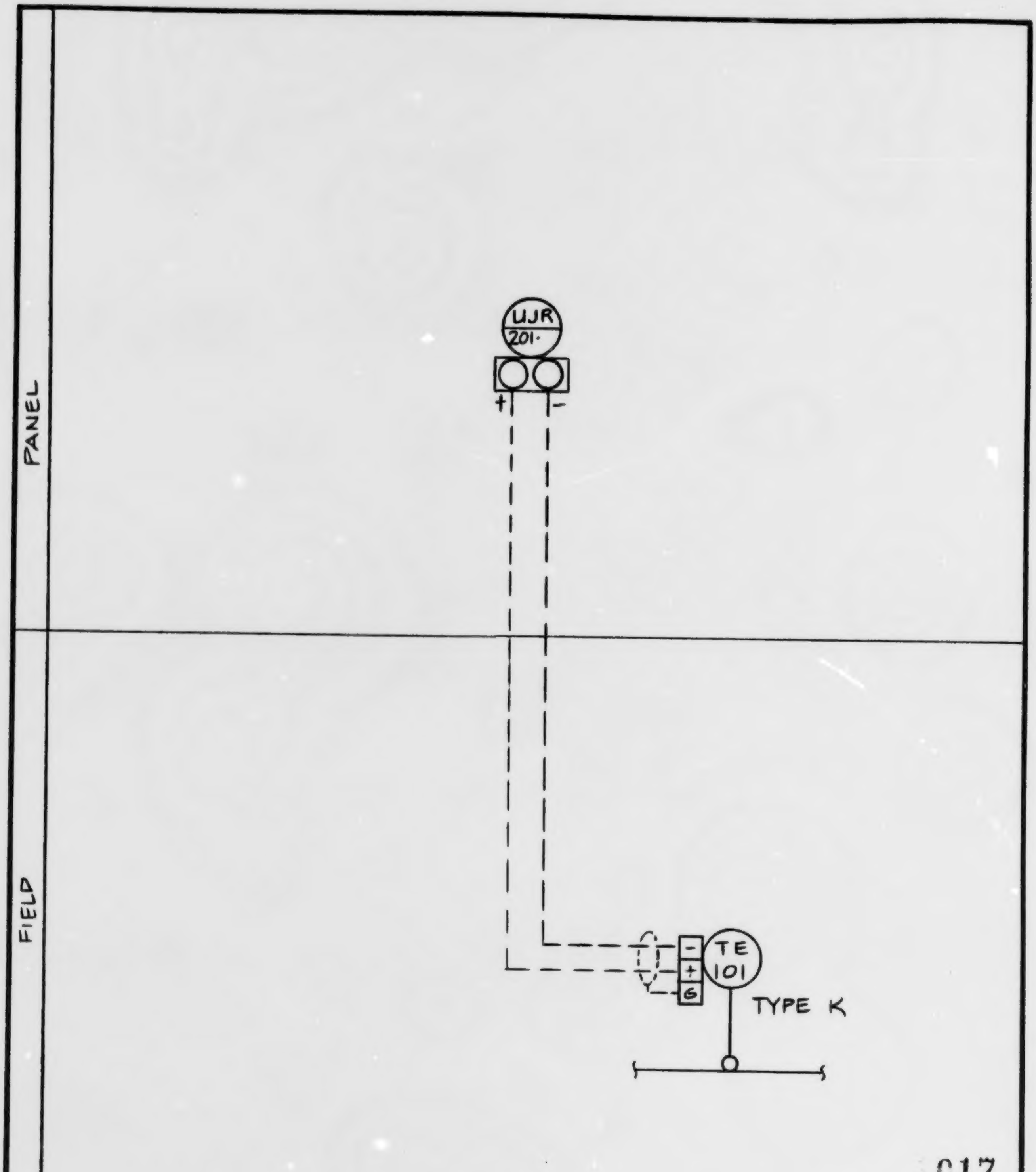
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER TO BAYONET
TUBE NO. 3 - FLOW

LOOP DIAGRAM

A	0243	8301	100	0


PANEL
UJR
201-
+
-
FIELD
-
+
G
TE
101
TYPE K

C17

ENERGY, MINES & RESOURCES CANADA

A R F B C
RESEARCH FACILITY

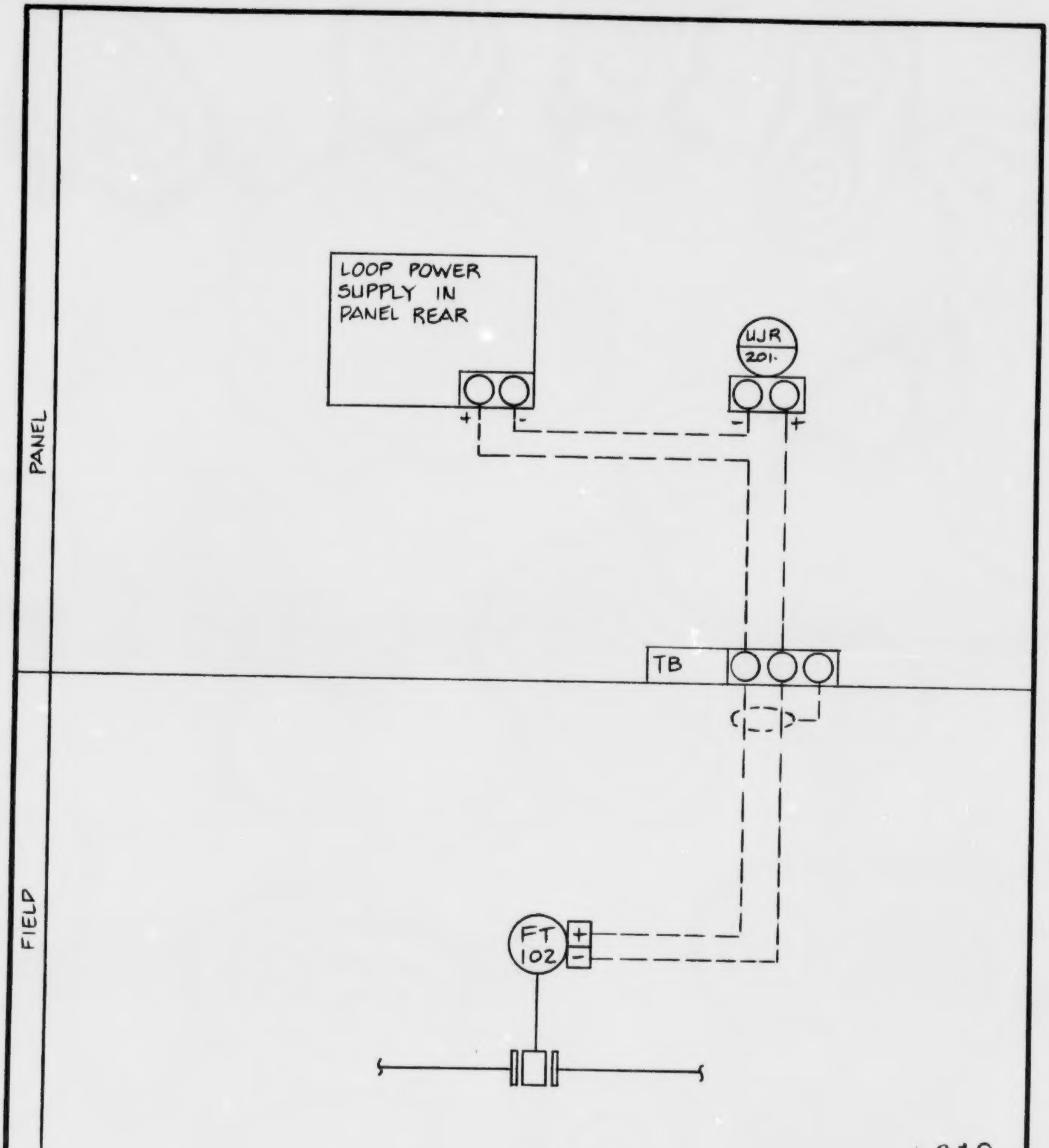
integ
Intercontinental Engineering Ltd

DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER FROM BAYONET TUBE NO. 3 - TEMPERATURE

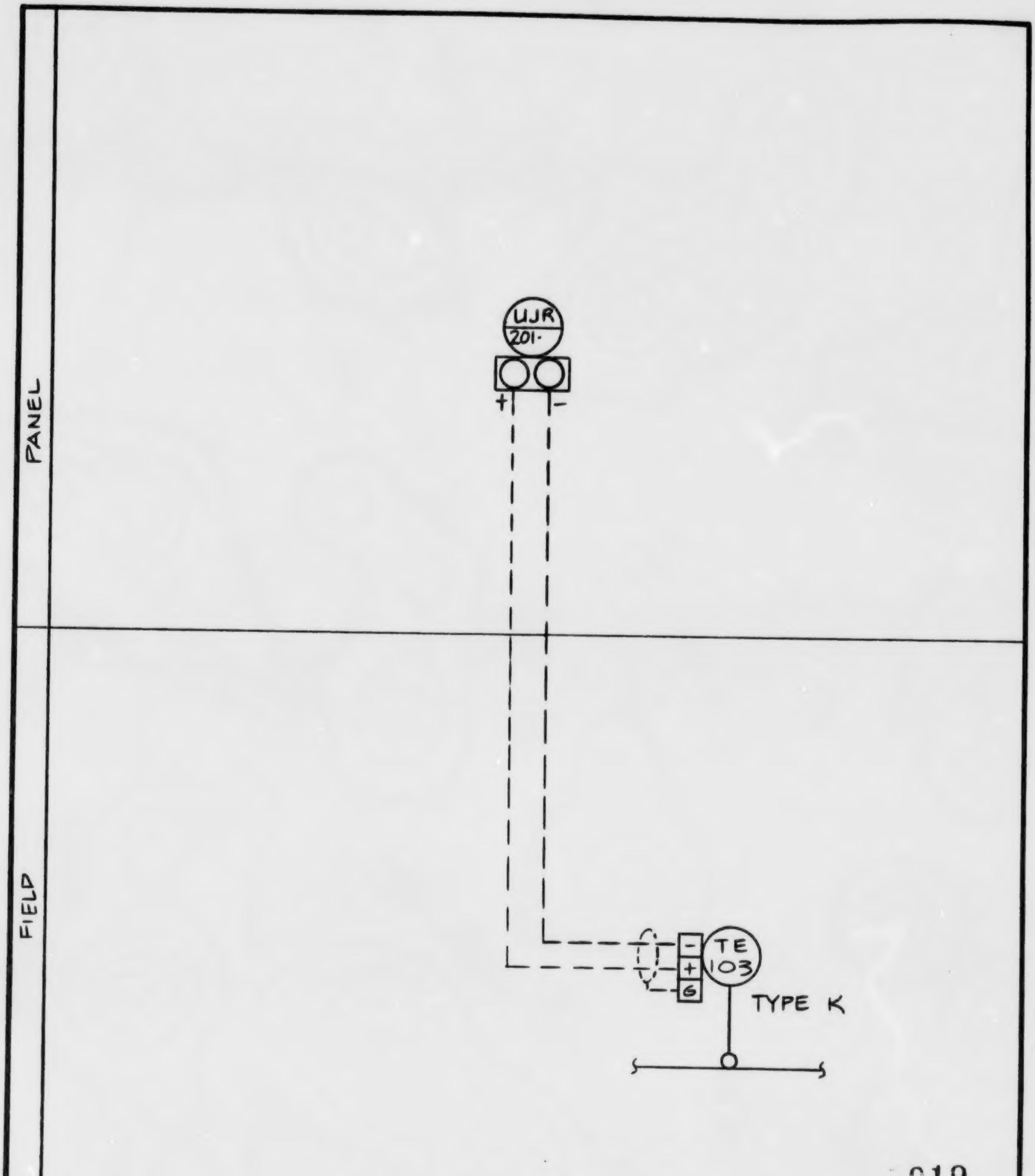
LOOP DIAGRAM

A	0243	8301	101	0


PANEL
FIELD
LOOP POWER SUPPLY IN PANEL REAR
+
-
UJR
201
-
+
TB
FT
102
+
-

C18

ENERGY, MINES & RESOURCES CANADA						**A R F B C RESEARCH FACILITY**
integ Intercontinental Engineering Ltd.	DWN	CHK	APP	DATE	RV	PLANT COOLING WATER TO BAYONET TUBE NO. 4 - FLOW
	AF				0	
						LOOP DIAGRAM
						A **0243** 8301 102 0


PANEL
UJR
201-
+
-
FIELD
-
+
G
TE
103
TYPE K

3019

ENERGY, MINES & RESOURCES CANADA

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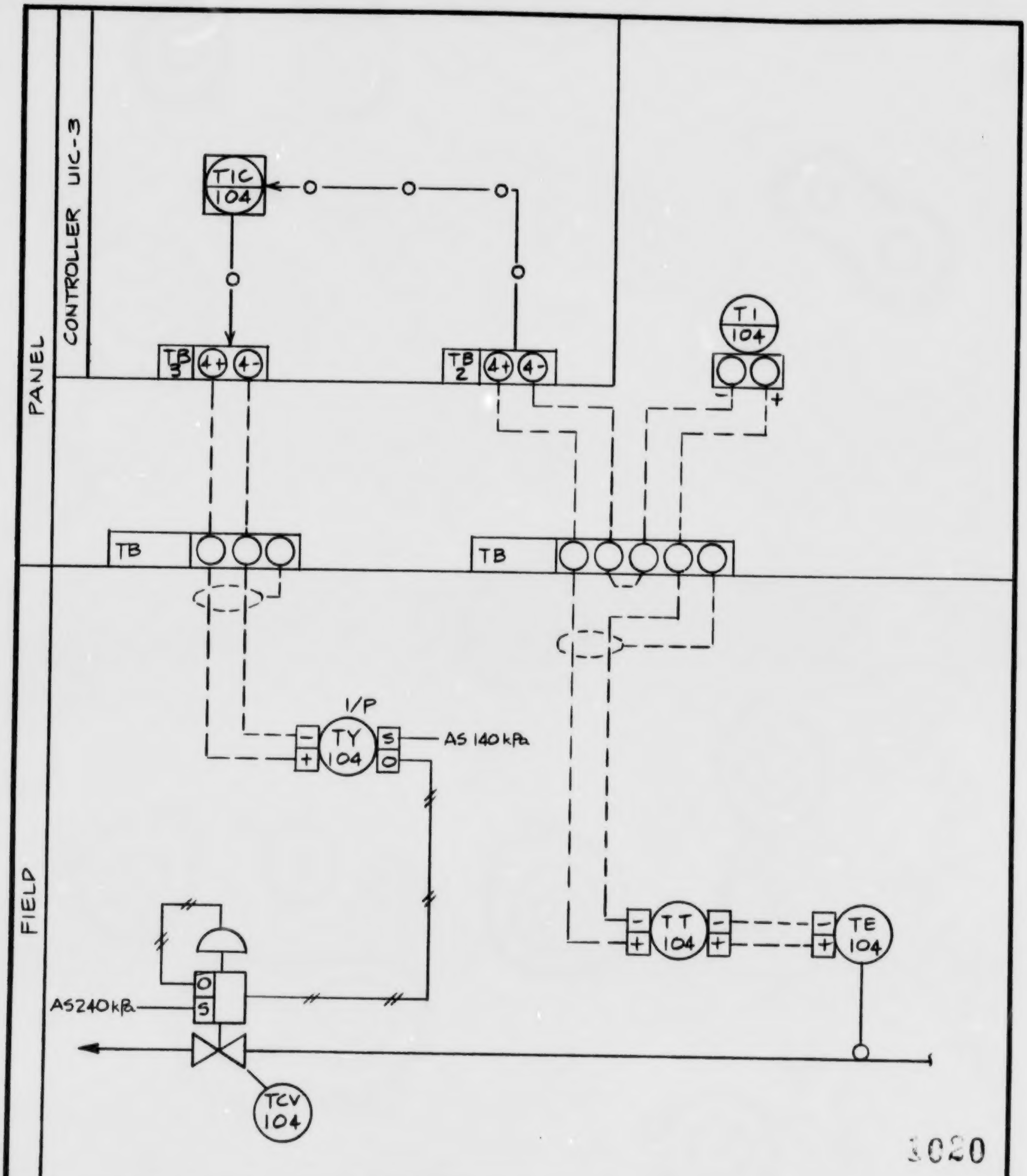
DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER FROM BAYONET TUBE NO.4 - TEMPERATURE

LOOP DIAGRAM

A	0243	8301	103	0


PANEL
CONTROLLER UIC-3
TIC 104
TB 3
4+
4-
TB 2
4+
4-
TI 104
-
+
TB
TB
FIELD
I/P
TY 104
-
+
S
O
AS 140 kPa
O
S
AS240kPa
TCV 104
TT 104
-
+
-
+
TE 104
-
+

3020

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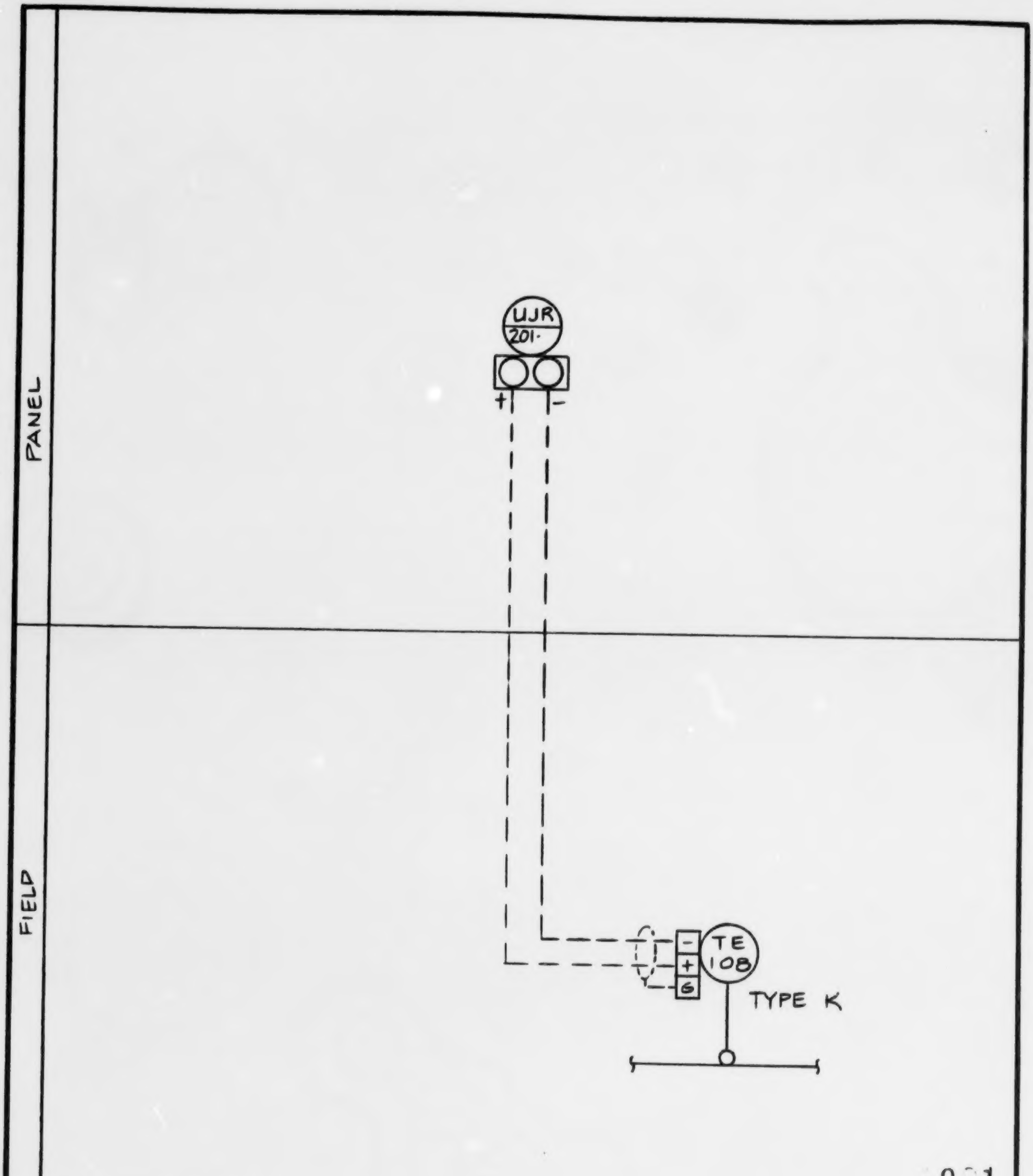
PLANT COOLING WATER FROM BAYONET TUBES - TEMPERATURE

LOOP DIAGRAM

A	**0243**	8301	104	0


PANEL
FIELD
UJR
201
+
-
TE
108
-
+
G
TYPE K

021

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DWN	CHK	APP	DATE	RV
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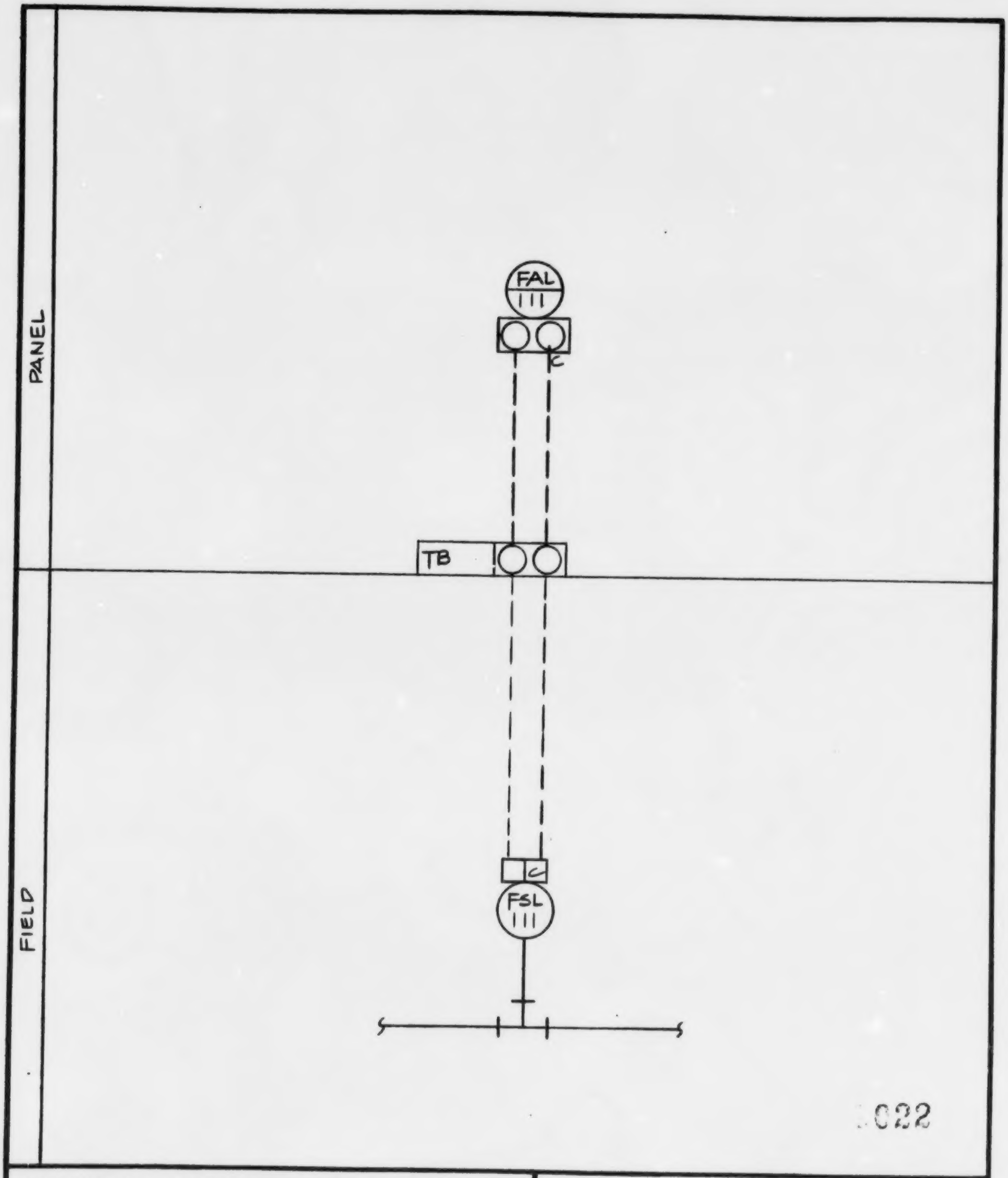
PLANT COOLING WATER FROM
TRANSFER CONVEYOR NO. 2 – TEMP.

LOOP DIAGRAM

A	**0243**	8301	108	0


PANEL
FAL
111
C
TB
C
FSL
111
FIELD

022

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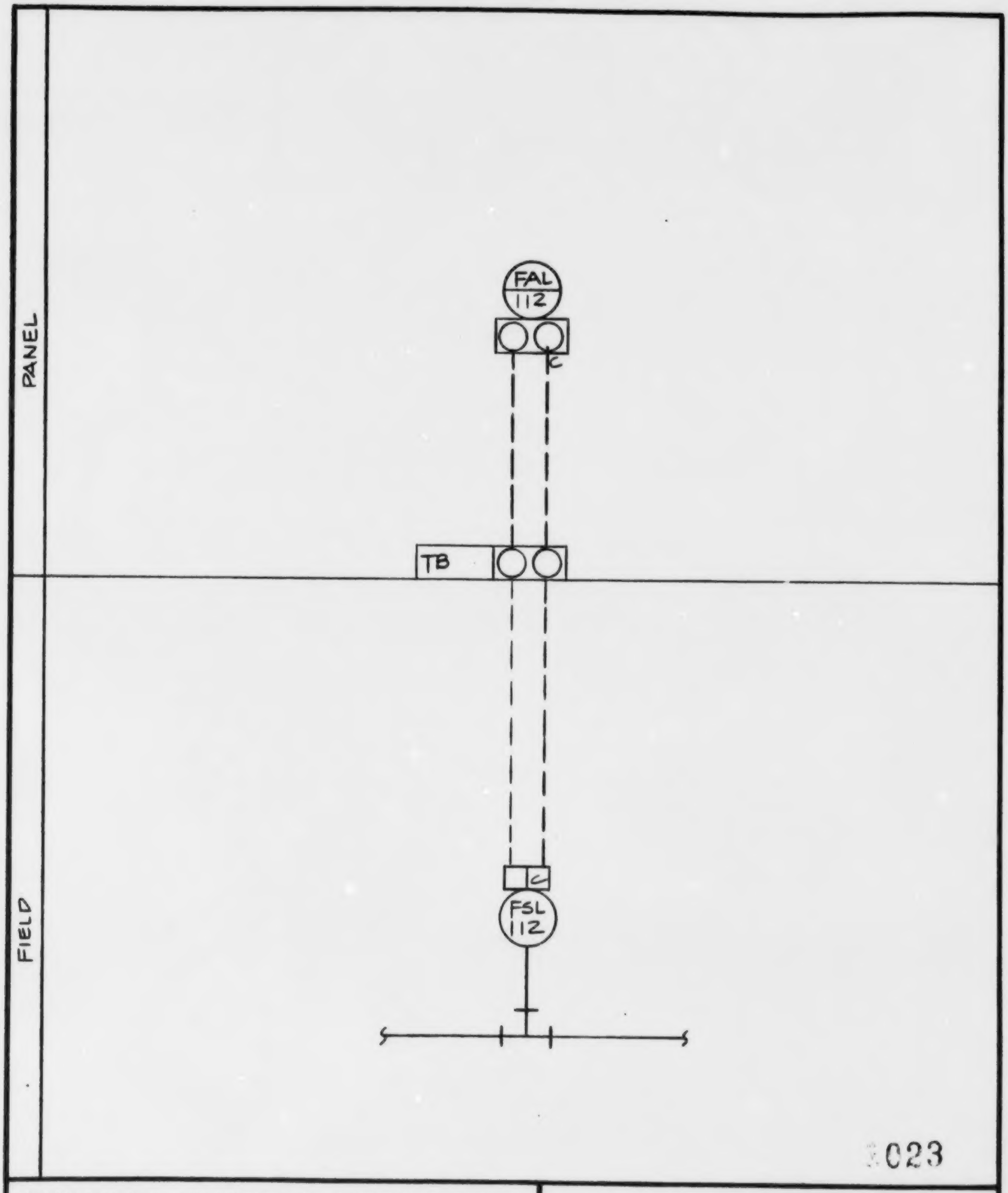
PLANT COOLING WATER FROM
BAYONET TUBE NO. 1 - FLOW

LOOP DIAGRAM

A	**0243**	8301	111	0


PANEL
FAL
112
C
TB
FIELD
C
FSL
112

023

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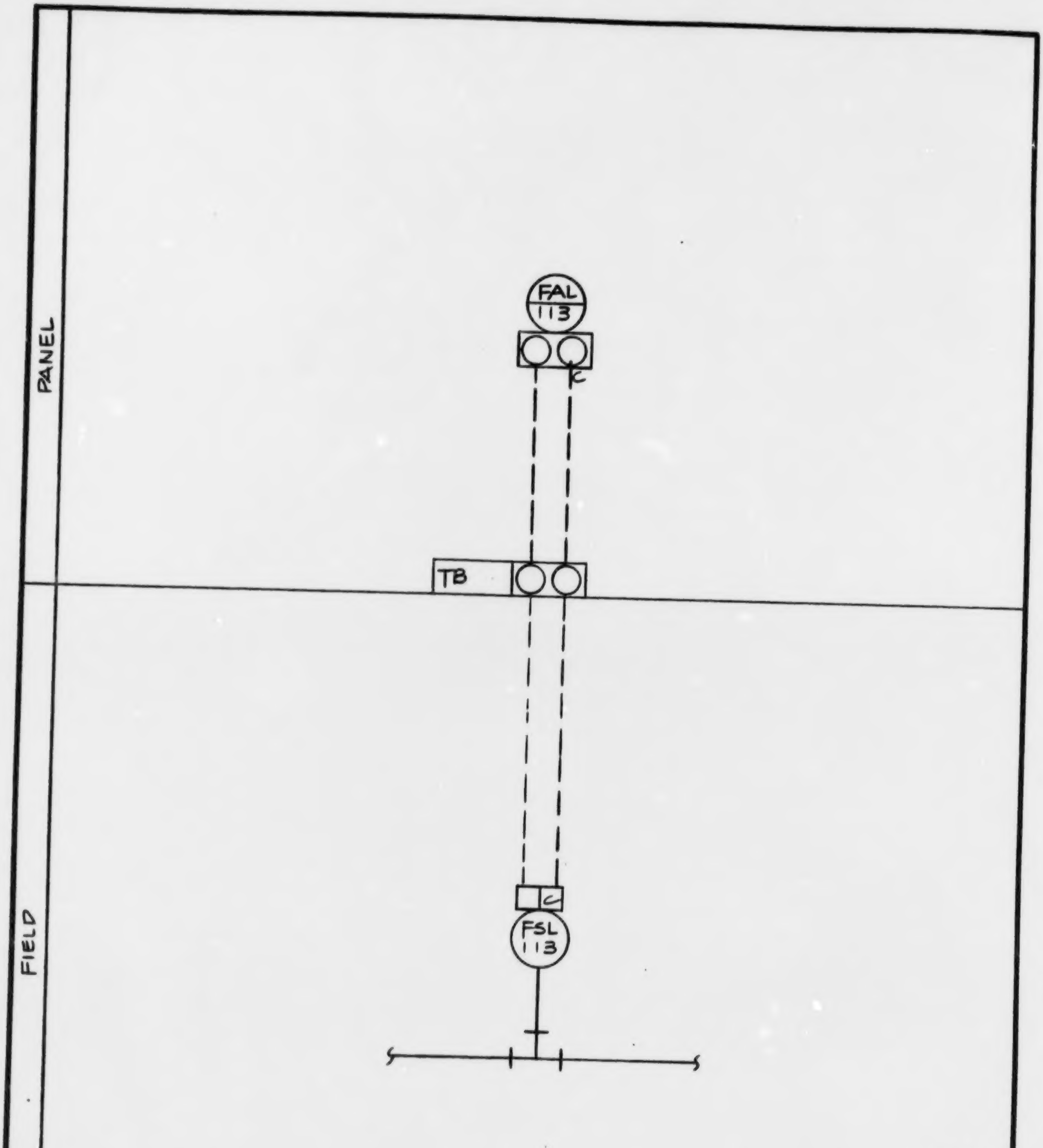
AF				0

PLANT COOLING WATER FROM
BAYONET TUBE NO. 2 - FLOW

LOOP DIAGRAM

A	0243	8301	112	0


PANEL
FIELD
FAL
113
C
TB
C
FSL
113

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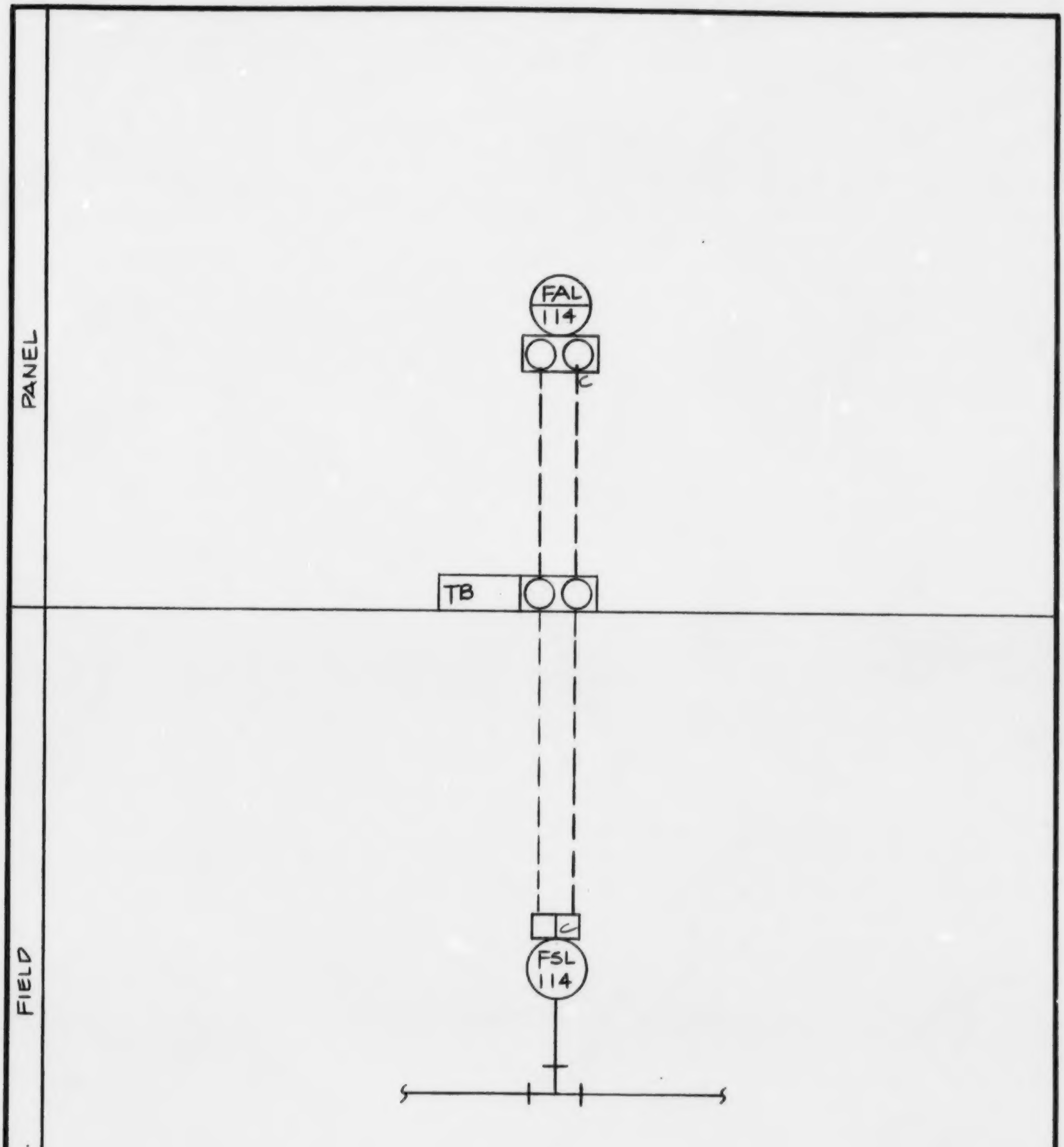
DWN	CHK	APP	DATE	RV
AF				0

PLANT COOLING WATER FROM
BAYONET TUBE NO. 3 - FLOW

LOOP DIAGRAM

A | **0243** | 8301 | 113 | 0


PANEL
FAL
114
C
TB
FIELD
C
FSL
114

1025

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DWN	CHK	APP	DATE	RV
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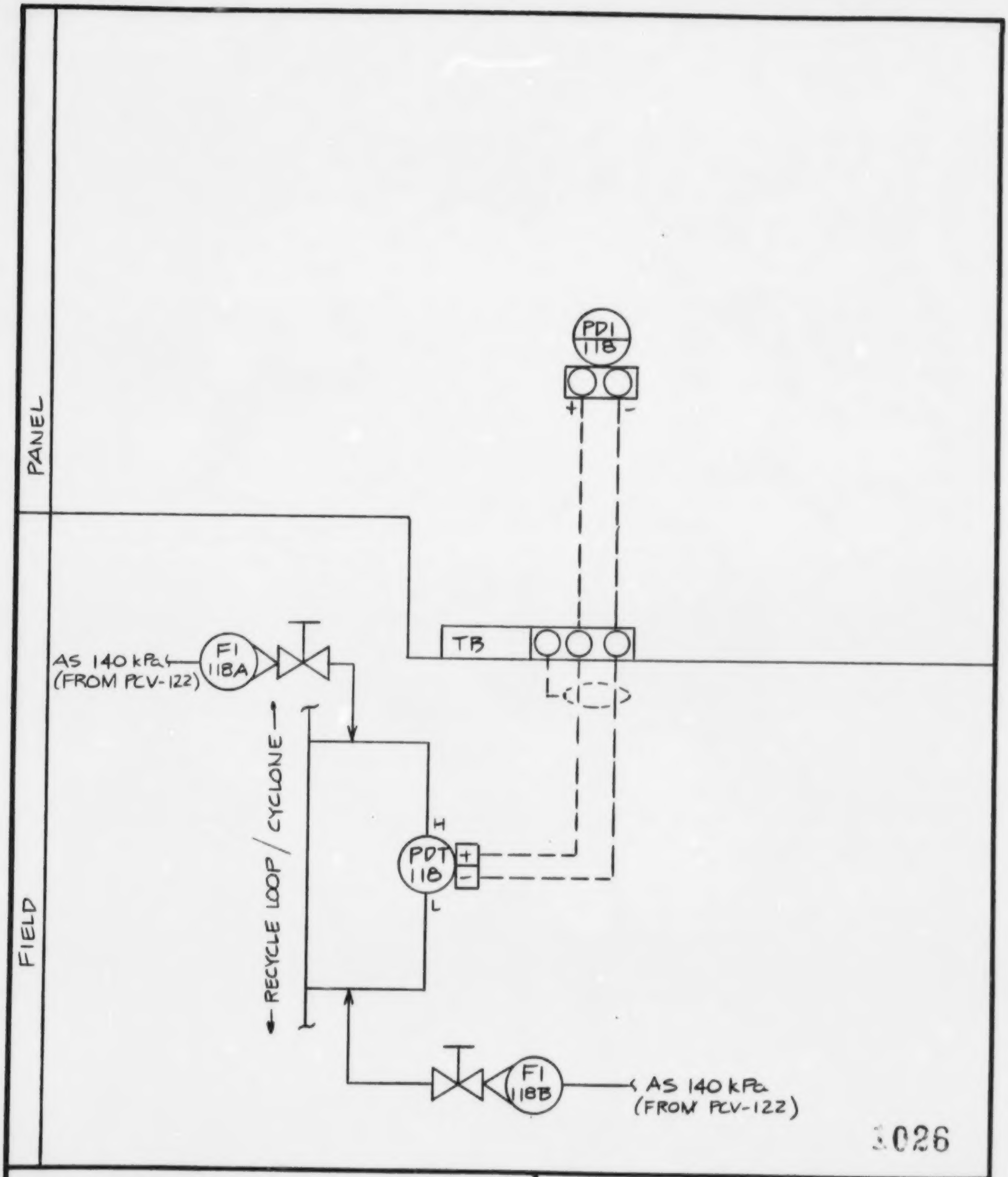
PLANT COOLING WATER FROM BAYONET TUBE NO. 4 - FLOW

LOOP DIAGRAM

A	0243	8301	114	0


PANEL
PDI
118
+
-
TB
L
AS 140 kPa
(FROM PCV-122)
FI
118A
RECYCLE LOOP / CYCLONE
H
PDT
118
+
-
L
FIELD
FI
118B
AS 140 kPa
(FROM PCV-122)

3026

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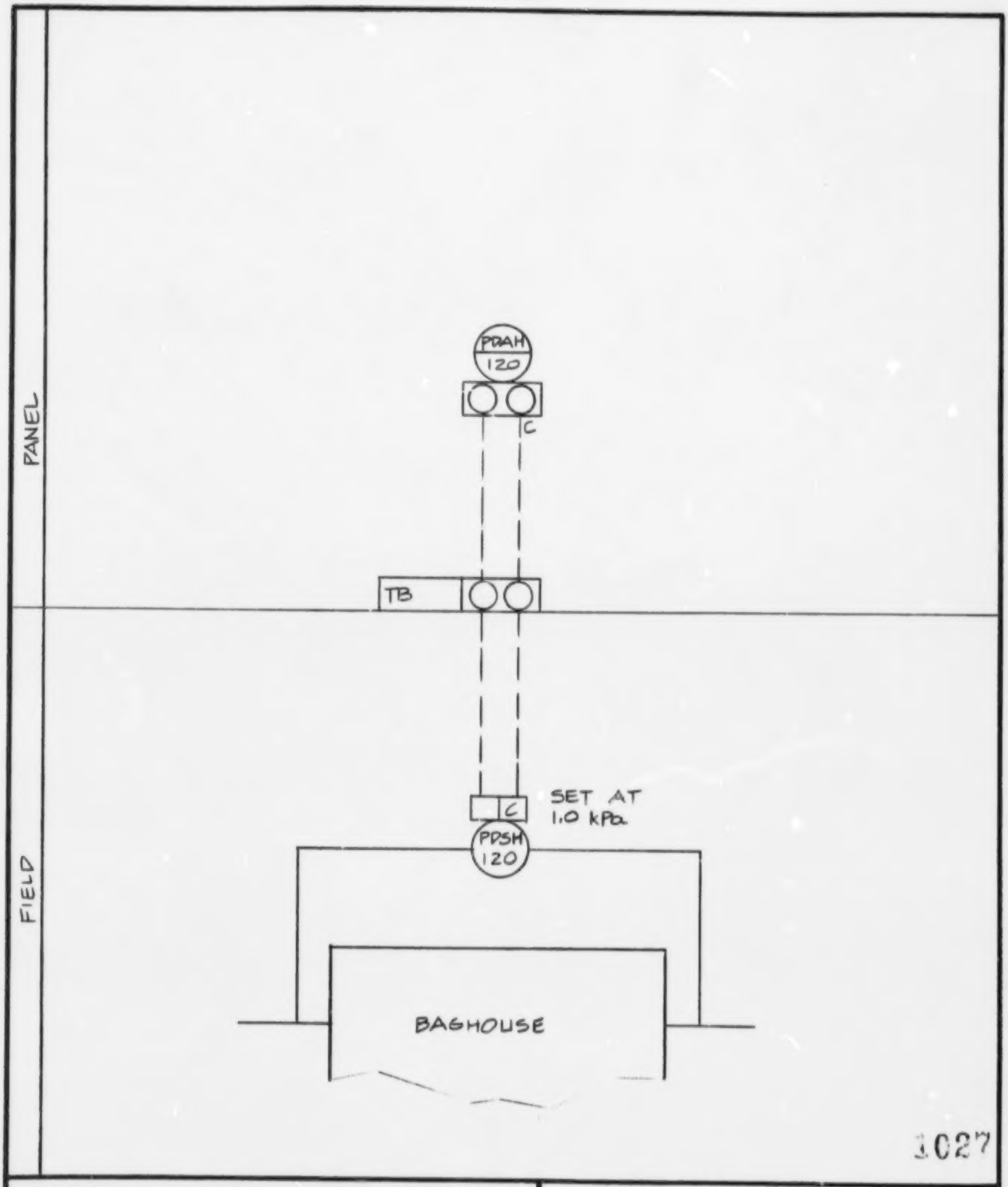
DWN	CHK	APP	DATE	RV
AF				0

CYCLONE OUTLET TO RECYCLE LOOP
- DIFFERENTIAL PRESSURE

LOOP DIAGRAM

A	**0243**	8301	118	0


PANEL
PDAH
120
C
TB
FIELD
SET AT
1.0 kPa
C
PDSH
120
BAGHOUSE

1027

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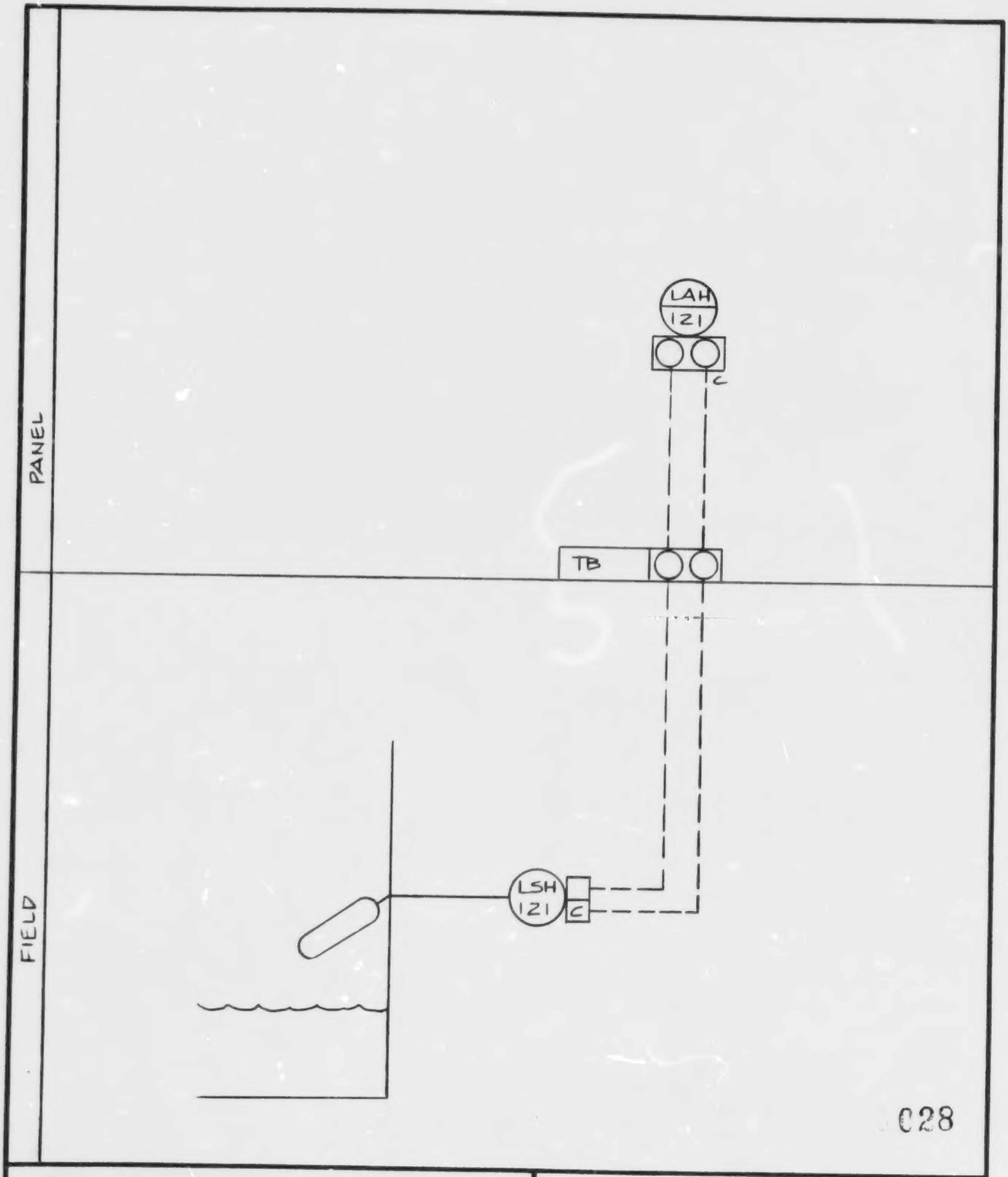
ΔF				0

BAGHOUSE FLUE GAS
– DIFFERENTIAL PRESSURE

LOOP DIAGRAM

A	0243	8301	120	0


PANEL
FIELD
LAH
121
C
TB
LSH
121
C

028

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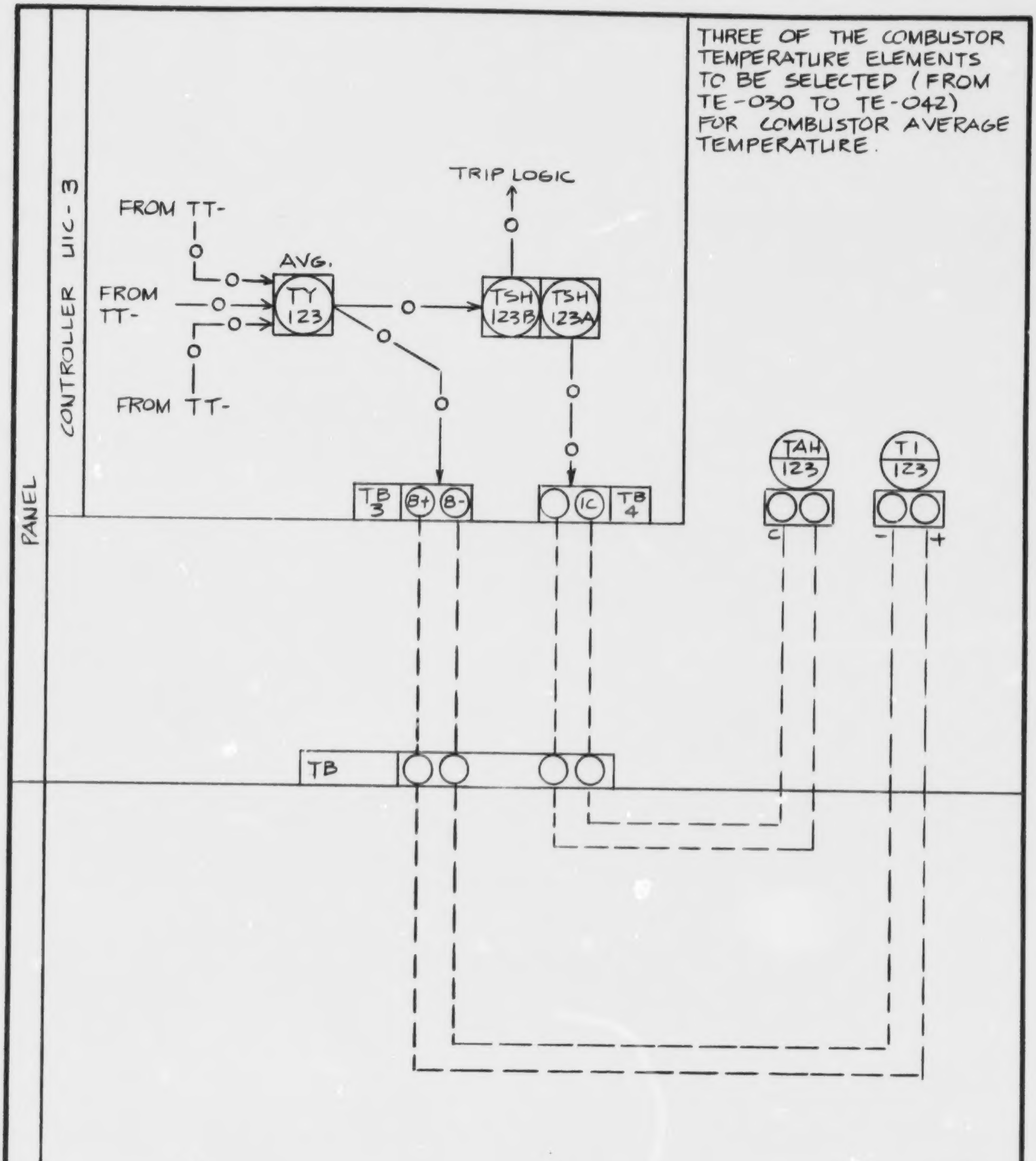
DWN	CHK	APP	DATE	RV
AF				0

COOLING TOWER REMOTE SUMP
- LEVEL

LOOP DIAGRAM

A	**0243**	8301	121	0


PANEL
CONTROLLER UIC-3
TRIP LOGIC
FROM TT-
FROM TT-
FROM TT-
AVG.
TY 123
TSH 123B
TSH 123A
TB 3
B+
B-
1C
TB 4
TAH 123
TI 123
C
-
+
TB

THREE OF THE COMBUSTOR TEMPERATURE ELEMENTS TO BE SELECTED (FROM TE-030 TO TE-042) FOR COMBUSTOR AVERAGE TEMPERATURE.

029

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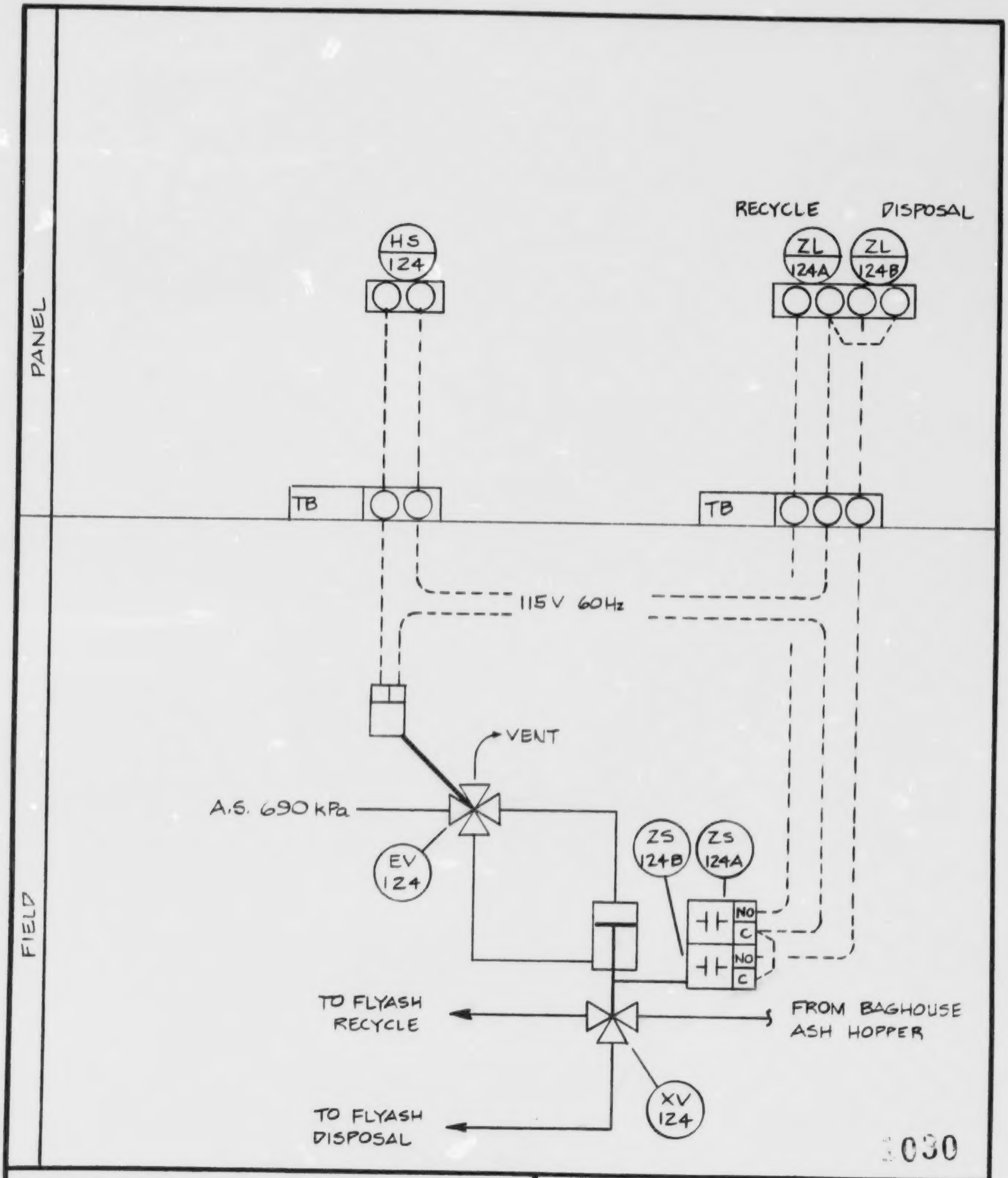
DWN	CHK	APP	DATE	RV
AF				0

COMBUSTOR
- AVERAGE TEMPERATURE

LOOP DIAGRAM

A	0243	8301	123	0


PANEL
FIELD
RECYCLE
DISPOSAL
HS 124
ZL 124A
ZL 124B
TB
TB
115V 60Hz
VENT
A.S. 690 kPa
EV 124
ZS 124B
ZS 124A
NO
C
NO
C
TO FLYASH RECYCLE
FROM BAGHOUSE ASH HOPPER
XV 124
TO FLYASH DISPOSAL
1030

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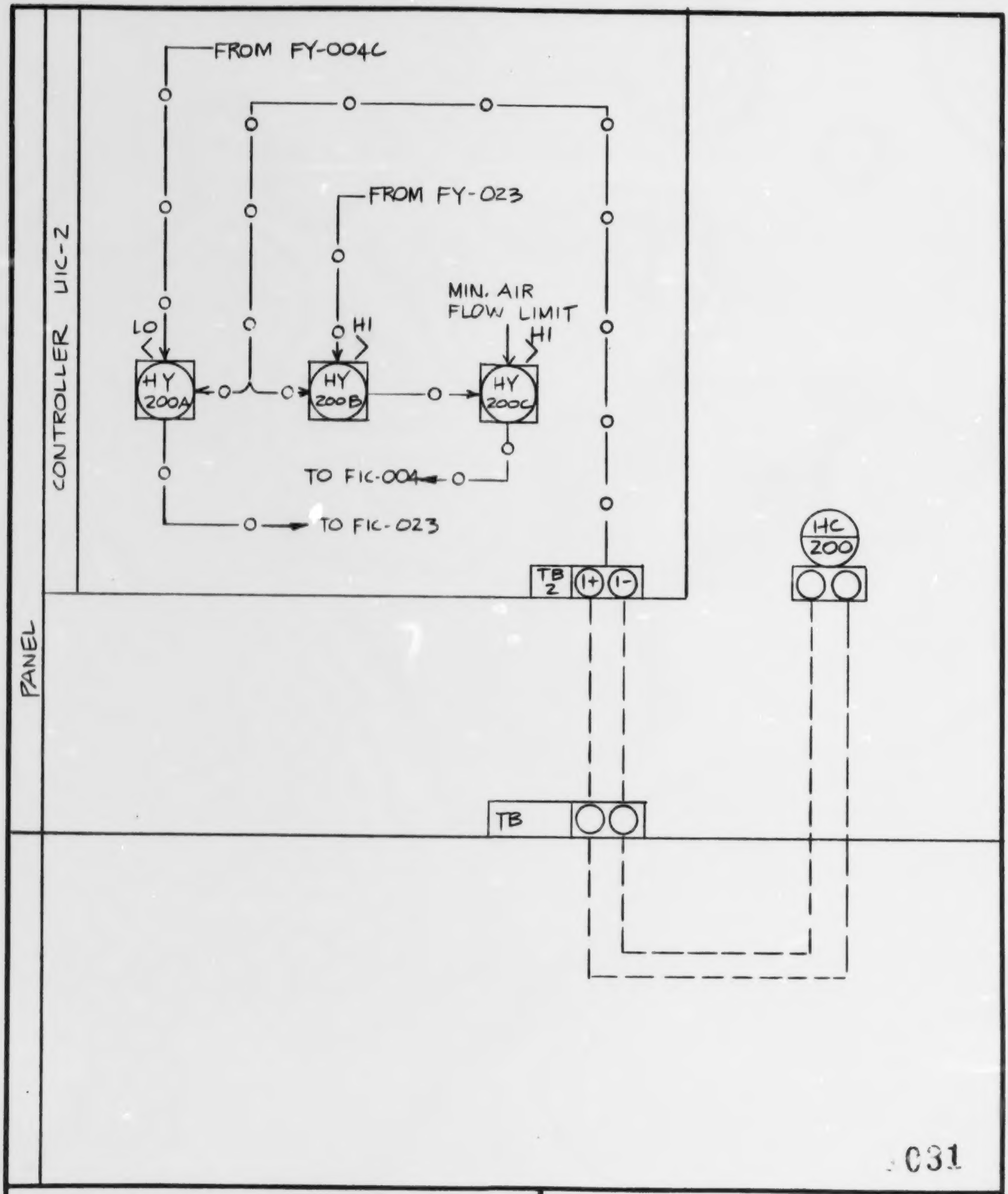
DWN	CHK	APP	DATE	RV
AF				0

FLYASH RECYCLE/DISPOSAL
(3 WAY VALVE) CONTROL

LOOP DIAGRAM

A	0243	8301	124	0


FROM FY-004C
FROM FY-023
MIN. AIR FLOW LIMIT
LO
HI
HI
HY 200A
HY 200B
HY 200C
TO FIC-004
TO FIC-023
CONTROLLER UIC-2
PANEL
TB 2
1+
1-
HC 200
TB

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DWN	CHK	APP	DATE	RV
AF				0

COMBUSTION CONTROL
(ENERGY INPUT DEMAND)

LOOP DIAGRAM

A	0243	8301	200	0

TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PI-001	F.D. BLOWER DISCHARGE - PRESSURE	ASHCROFT 1279 SSL				8725	FIELD		
PT-002	COMBUSTION AIR HEADER - PRESSURE	ROSEMOUNT 1151 GP				8713	FIELD		
PIC-002				SEE UIC-1			PANEL		
PY-002		FISHER 546-2		I/P TRANSDUCER		8704	FIELD		
PCV-002	COMBUSTION AIR HEADER - PRESSURE	FISHER 9500-1051 -3511				8704	FIELD		
TEW-003	COMBUSTION AIR HEADER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-003		THERMO-ELECTRIC				8718	FIELD		
TT-003	COMBUSTION AIR HEADER - TEMPERATURE	ROSEMOUNT 444-TK1				8716	FIELD		

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DWN	CHK	APP	DATE	REV
AF				0

INSTRUMENT LIST

A 0243 8401 0

SHT 1 OF 46

TAG	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
NUMBER		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
FE-004	TOTAL AIR TO COMBUSTOR - FLOW	DANIEL				8705	FIELD		
FT-004		ROSEMOUNT 1151 DP + M4AVS				8709	FIELD		
FY-004A				SQUARE ROOT			SOFTWARE		
FY-004B				FLOW PRESSURE AND TEMPERATURE COMPENSATION			SOFTWARE		
FR-004				UR-1: PEN 1- FR-004 PEN 2- FR-007 PEN 3- FR-010			PANEL		
FSL-004							SOFTWARE		
FAL-004				SEE UA-1			PANEL		
FY-004C				DIVIDER			SOFTWARE		
HC-004				AIR: FUEL RATIO STATION			PANEL		
FIC-004				SEE UIC-2			PANEL		
FY-004 D		FISHER 546-2		I/P TRANSDUCER		8704	FIELD		
FCV-004	TOTAL AIR TO COMBUSTOR - FLOW	FISHER 9500-1051 -3511				8704	FIELD		

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DWN	CHK	APP	DATE	REV
AF				0

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SHT 2 OF 46

TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
005	< NOT USED >								
FO-006	PRIMARY AIR - FLOW	DANIEL		RESTRICTION ORIFICE		8705	FIELD		
FP-006A	↓			TEST CONN.			FIELD		
FP-006B	PRIMARY AIR - FLOW			TEST CONN.			FIELD		

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AF				0

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SHT 3 OF 46

TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FY-007A	PRIMARY AIR - FLOW			SUMMER			SOFTWARE		
FY-007B				SUMMER			SOFTWARE		
FR-007				UR-1 PEN1: FR-004 PEN2: FR-007 PEN3: FR-010			PANEL		
FSL-007A				ALARM			SOFTWARE		
FSL-007B				INTERLOCK			SOFTWARE		
FAL-007	PRIMARY AIR - FLOW			SEE UA-1			PANEL		
PT-008	PRIMARY AIR WINDBOX - PRESSURE	ROSEMOUNT 1151GP				8713	FIELD		
PI-008				UI-1 PT.1: PI-008 PT.2: PI-043			PANEL		
PSL-008							IN PI-008		
PAL-008	PRIMARY AIR WINDBOX - PRESSURE			SEE UA-1			PANEL		

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A	0243		8401	0

SHT 4 OF 46

TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
PT-009	SECONDARY AIR BEFORE FLOW ELEMENT - PRESSURE	ROSEMOUNT 1151GP				8713	FIELD		
FE-010	SECONDARY AIR - FLOW	DANIEL				8706	FIELD		
FT-010		ROSEMOUNT 1151 DP + M4 AVS				8709	FIELD		
FY-010A				SQLIARE ROOT			SOFTWARE		
FY-010B				FLOW PRESSURE AND TEMPERATURE COMPENSATION			SOFTWARE		
FR-010				UR-1 PEN1: FR-004 PEN2: FR-007 PEN3: FR-010			PANEL		
FFIC-010				SEE UIC-1			PANEL		
FY-010C		FISHER 546-2		I/P TRANSDUCER		8704	FIELD		
FCV-010	SECONDARY AIR - FLOW	FISHER 9500-1051 -3511				8704	FIELD		

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SHT 5 OF 46

TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
FI-011	SECONDARY AIR TO ZONE 1 - FLOW	BROOKS 1114		ROTAMETER c/w MANUAL VALVE		8739	FIELD		
FI-012	SECONDARY AIR TO ZONE 2 - FLOW	BROOKS 1114		ROTAMETER c/w MANUAL VALVE		8739	FIELD		
FI-013	SECONDARY AIR TO ZONE 3 - FLOW	BROOKS 1114		ROTAMETER c/w MANUAL VALVE		8739	FIELD		
FI-014	SECONDARY AIR TO ZONE 4 - FLOW	BROOKS 1114		ROTAMETER c/w MANUAL VALVE		8739	FIELD		
FI-015	SECONDARY AIR TO ZONE 5 - FLOW	BROOKS 1114		ROTAMETER c/w MANUAL VALVE		8740	FIELD		

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AF				0

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SHT 6 OF 46

TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
016	< NOT USED >								

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FE-017	LOOP SEAL AIR - FLOW	DANIEL				8706	FIELD		
FT-017		ROSEMOUNT 1151-DP + M4AVS				8709	FIELD		
FY-017A				SQUARE ROOT			SOFTWARE		
FIC-017				SEE UIC-3			PANEL		
FY-017 B		FISHER 546-2		I/P TRANSDUCER		8703	FIELD		
FCV-017	LOOP SEAL AIR - FLOW	FISHER 657-ES				8703	FIELD		

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AF				0

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SHT 8 OF 46

TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
FE-018	FLY ASH RECYCLE AIR - FLOW	DANIEL				8706	FIELD		
FT-018		ROSEMOUNT 1151-DP +M4AVS				8710	FIELD		
FY-018A				SQUARE ROOT			SOFTWARE		
FIC-018				SEE UIC-3			PANEL		
FY-018B		FISHER 546-2		I/P TRANSDUCER		8703	FIELD		
FCV-018	FLY ASH RECYCLE AIR - FLOW	FISHER 657-ES -3582				8703	FIELD		
PI-019	FLY ASH RECYCLE AIR - PRESSURE	ASHCROFT 1279SS				8725	FIELD		

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DWN	CHK	APP	DATE	REV
AF				0

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
ST-020	ROTARY FEEDER AT BAGHOUSE FLYASH DISCH. - SPEED		WITH DRIVE				FIELD		
SI-020	↓		WITH DRIVE				PANEL		
HC-020	ROTARY FEEDER AT BAGHOUSE FLYASH DISCH. - SPEED		WITH DRIVE	SPEED SETTING			PANEL		
LSH-021	FUEL BIN - LEVEL		WITH BIN				FIELD		
LAH-021	FUEL BIN - LEVEL			SEE UA-1			PANEL		
LSL-022	FUEL BIN - LEVEL		WITH BIN				FIELD		
LAL-022	FUEL BIN - LEVEL			SEE UA-1			PANEL		

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SHT 10 OF 46

TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FT-023	FUEL TO COMBUSTOR - FLOW		WITH FEEDER				FIELD		
FI-023			WITH FEEDER				FIELD		
FY-023				MULTPLIER			SOFTWARE		
HC-023				FUEL HEATING VALUE INPUT STN. SEE UIC-2			PANEL		
FIC-023				SEE UIC-2			PANEL		
FR-023				UR-2 PEN1: FR-023 PEN2: FR-027 PEN3: SPARE			PANEL		
FK-023	FUEL TO COMBUSTOR - FLOW		WITH FEEDER				FIELD		
FSH-024	FUEL FEEDER - FLOW		WITH FEEDER	OVERFEED SWITCH			FIELD		
FSL-024			WITH FEEDER	UNDERFEED SWITCH			FIELD		
FAH-024				SEE UA-1			PANEL		
FAL-024	FUEL FEEDER - FLOW			SEE UA-1			PANEL		

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A	0243		8401	0

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
LSH-025	LIMESTONE BIN - LEVEL		WITH BIN				FIELD		
LAH-025	LIMESTONE BIN - LEVEL			SEE UA-1			PANEL		
LSL-026	LIMESTONE BIN - LEVEL		WITH BIN				FIELD		
LAL-026	LIMESTONE BIN - LEVEL			SEE UA-1			PANEL		
FT-027	LIMESTONE TO COMBUSTOR - FLOW		WITH FEEDER				FIELD		
FI-027			WITH FEEDER				FIELD		
FFIC-027				SEE UIC-2			PANEL		
FR-027				UR-2 PEN 1: FR-023 PEN 2: FR-027 PEN 3: SPARE			PANEL		
FK-027	LIMESTONE TO COMBUSTOR - FLOW		WITH FEEDER				FIELD		

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AF				0

INSTRUMENT LIST

A	0243		8401	0

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FSH-028	LIMESTONE FEEDER - FLOW		WITH FEEDER	OVERFEED SWITCH			FIELD		
FSL-028	↓		WITH FEEDER	UNDERFEED SWITCH			FIELD		
FAH-028	↓			SEE UA-1					
FAL-028	LIMESTONE FEEDER - FLOW			SEE UA-1					
ST-029	ROTARY FEEDER AT TRANS. CONV. NO.1 DISCH. - SPEED		WITH DRIVE				FIELD		
SI-029	↓		WITH DRIVE				PANEL		
HC-029	ROTARY FEEDER AT TRANS. CONV. NO 1 DISCH. - SPEED		WITH DRIVE	SPEED SETTING			PANEL		
TEW-030	COMBUSTOR (EL. 150 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-030	COMBUSTOR (EL. 150 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-031	COMBUSTOR (EL. 150 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-031	COMBUSTOR (EL. 150 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		

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DWN	CHK	APP	DATE	REV
AF				0

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A 0243 8401 0

SHT 12 OF 46

TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
TEW-032	COMBUSTOR (EL. 460 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-032	COMBUSTOR (EL. 460 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-033	COMBUSTOR (EL. 760 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-033	COMBUSTOR (EL. 760 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-034	COMBUSTOR (EL. 1070 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-034	COMBUSTOR (EL 1070 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-035	COMBUSTOR (EL. 1680 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-035	COMBUSTOR (EL. 1680 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-036	COMBUSTOR (EL. 2290mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-036	COMBUSTOR (EL. 2290mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-037	COMBUSTOR (EL 2900mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-037	COMBUSTOR (EL. 2900mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-038	COMBUSTOR (EL. 3510) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-038	COMBUSTOR (EL. 3510) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-039	COMBUSTOR (EL 4110mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-039	COMBUSTOR (EL. 4110mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-040	COMBUSTOR (EL 4720mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-040	COMBUSTOR (EL 4720mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-041	COMBUSTOR (EL 5330 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-041	COMBUSTOR (EL. 5330 mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TEW-042	COMBUSTOR (EL. 5940mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-042	COMBUSTOR (EL. 5940mm) - TEMPERATURE		WITH COMBUSTOR				FIELD		
TT-		ROSEMOUNT 444-TK3		3 OF COMBUSTOR TEMP ELEMENTS TE-030 TO TE-042 ARE TO BE SELECTED FOR DERIVING COMBUSTOR AVERAGE TEMP. THESE TT TO BE PLACED WITH THEIR LOOPS WHEN KNOWN		8736	FIELD		
TT-		ROSEMOUNT 444-TK3				8736	FIELD		
TT-		ROSEMOUNT 444-TK3				8736	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PT-043	FLUIDIZED BED (ABOVE PRIMARY AIR DISTRIBUTOR) - PRESSURE	ROSEMOUNT 1151-GP				8713	FIELD		
PI-043				UI-1 PT. 1: PI-008 PT. 2: PI-043			PANEL		
FI-043		BROOKS 1350-8900		PURGE METER		8730	FIELD		
PSL-043							IN PI-043		
PAL-043	FLUIDIZED BED (ABOVE PRIMARY AIR DISTRIBUTOR) - PRESSURE			SEE UA-1			PANEL		
PP-044	COMBUSTOR (EL. 150mm) - PRESSURE			TEST CONN. SHARED WITH PT-043 TAPPING			FIELD		
PP-045	COMBUSTOR (EL. 460mm) - PRESSURE						FIELD		
PP-046	COMBUSTOR (EL. 760mm)						FIELD		

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TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
PP-047	COMBUSTOR (EL 1070mm) - PRESSURE						FIELD		
PP-048	COMBUSTOR (EL. 1370mm) - PRESSURE						FIELD		
PP-049	COMBUSTOR (EL. 2290mm) - PRESSURE						FIELD		
PP-050	COMBUSTOR (EL. 3200mm) - PRESSURE						FIELD		
PSH-051	COMBUSTOR - PRESSURE	ASHCROFT B424B		INTERLOCK		8723	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PT-052	COMBUSTOR - PRESSURE	ROSEMOUNT 1151-GP				8714	FIELD		
PIC-052				SEE UIC-2			PANEL		
PI-052				UI-5: PT. 1: PI-052 PT 2: TI-123			PANEL		
PSH-052							SOFTWARE		
PSL-052							SOFTWARE		
PAH-052				SEE UA-1			PANEL		
PAL-052				SEE UA-1			PANEL		
PY-052		FISHER 546-2		I/P TRANSDUCER		8703	FIELD		
PCV-052	COMBUSTOR - PRESSURE	FISHER 7600-1051 -3511				8703	FIELD		
FI-052	COMBUSTOR - PRESSURE	BROOKS 1350-8900		PURGE METER		8730	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-053	COMBUSTOR OUTLET DUCT TO CYCLONE - TEMPERATURE					8718	FIELD		
TE-053						8718	FIELD		
TT-053		ROSEMOUNT 444-TK3				8716	FIELD		
TI-053	COMBUSTOR OUTLET DUCT TO CYCLONE - TEMPERATURE			UI-6: PT.1: TI-053 PT.2: TI-063			PANEL		
PP-054	COMBUSTOR OUTLET DUCT TO CYCLONE - PRESSURE						FIELD		
TEW-055	COMBUSTOR CYCLONE - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-055	COMBUSTOR CYCLONE - TEMPERATURE		WITH COMBUSTOR				FIELD		
PP-056	COMBUSTOR CYCLONE OUTLET TO RECYCLE LOOP - PRESSURE						FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-057	RECYCLE LOOP BEFORE LOOP SEAL AERATION PORTS - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-057	RECYCLE LOOP BEFORE LOOP SEAL AERATION PORTS - TEMPERATURE		WITH COMBUSTOR				FIELD		
PP-058	RECYCLE LOOP AT LOOP SEAL AERATION PORTS - PRESSURE						FIELD		
PP-059	RECYCLE LOOP AFTER LOOP SEAL AERATION PORTS - PRESSURE						FIELD		
TEW-060	RECYCLE LOOP AFTER LOOP SEAL AERATION PORTS - TEMPERATURE		WITH COMBUSTOR				FIELD		
TE-060	RECYCLE LOOP AFTER LOOP SEAL AERATION PORTS - TEMPERATURE		WITH COMBUSTOR				FIELD		
AP-061	CYCLONE GAS OUTLET - GAS ANALYSIS			SAMPLING POINT FOR FUTURE ANALYZER(s)			FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PT-062	CYCLONE GAS OUTLET - PRESSURE	ROSEMOUNT 1151-GP				8714	FIELD		
PI-062	CYCLONE GAS OUTLET - PRESSURE			UI-3: PT.1: PI-062 PT.2: PI-066			PANEL		
FI-062	CYCLONE GAS OUTLET - PRESSURE	BROOKS 1350-8900		PURGE METER		8730	FIELD		
TEW-063	CYCLONE GAS OUTLET - TEMPERATURE	THERMO ELECTRIC				8718	FIELD		
TE-063	↓	THERMO ELECTRIC				8718	FIELD		
TT-063		ROSEMOUNT 444-TK2				8716	FIELD		
TI-063	CYCLONE GAS OUTLET - TEMPERATURE			UI-6: PT.1: TI-053 PT.2: TI-063			PANEL		
PDT-064	PRIMARY AIR DISTRIBUTION NOZZLES - DIFFERENTIAL PRESS.	ROSEMOUNT 1151-DP +M4AVS				8714	FIELD		
PDI-064	PRIMARY AIR DISTRIBUTION NOZZLES - DIFFERENTIAL PRESS.			UI-2: PT.1: PDI-064 PT.2: PDI-065			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PDT-065	FLUIDIZED BED BASE TO COMBUSTOR OUTLET - DIFFERENTIAL PRESSURE	ROSEMOUNT 1151-DP + M4AVS				8714	FIELD		
PDI-065				UI-2: PT.1: PDI-064 PT.2: PDI-065			PANEL		
PDSH-065							IN PDI-065		
PDSL-065							IN PDI-065		
PDAH-065				SEE UA-1			PANEL		
PDAL-065	FLUIDIZED BED BASE TO COMBUSTOR OUTLET - DIFFERENTIAL PRESSURE			SEE UA-1			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PT-066	FLUE GAS COOLER GAS OUTLET - PRESSURE	ROSEMOUNT 1151-GP				8715	FIELD		
PI-066	FLUE GAS COOLER GAS OUTLET - PRESSURE			UI-3: PT.1: PI-062 PT.2: PI-066			PANEL		
FI-066	FLUE GAS COOLER GAS OUTLET - PRESSURE	BROOKS 1350-8900		PURGE METER		8730	FIELD		
TEW-067	FLUE GAS COOLER GAS OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-067	↓	THERMO-ELECTRIC				8718	FIELD		
TT-067	↓	ROSEMOUNT 444-TK1				8716	FIELD		
TI-067	FLUE GAS COOLER GAS OUTLET - TEMPERATURE			UI-7: PT.1: TI-067 PT.2: SPARE			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TSH-068	FLUE GAS COOLER GAS OUTLET - TEMPERATURE	ASHCROFT T424T15				8724	FIELD		
TAH-068	FLUE GAS COOLER GAS OUTLET - TEMPERATURE			SEE UA-1			PANEL		
PP-069	BAGHOUSE FLUE GAS INLET - PRESSURE			TEST CONN. SHARES PDT-070 TAPPING			FIELD		
PDT-070	BAGHOUSE FLUE GAS - DIFFERENTIAL PRESS.	ROSEMOUNT 1151-DP + M4AVS				8715	FIELD		
PDI-070	BAGHOUSE FLUE GAS - DIFFERENTIAL PRESS.			UI-4 PT.1 : PI-070 PT.2 : PI-118			PANEL		
FI-070	BAGHOUSE FLUE GAS - DIFFERENTIAL PRESS	BROOKS 1350-8900		PURGE METER ON BAGHOUSE INLET SIDE TAPPING		8730	FIELD		
PP-071	BAGHOUSE FLUE GAS OUTLET - PRESSURE			TEST CONN SHARES PDT-070 TAPPING			FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-072	I.D. FAN FLUE GAS INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-072	I.D. FAN FLUE GAS INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
AP-073	STACK FLUE GAS - ANALYSIS			SAMPLING POINT FOR FUTURE ANALYZERS			FIELD		
TEW-074	COOLING TOWER REMOTE SUMP MAKE UP WATER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-074	COOLING TOWER REMOTE SUMP MAKE UP WATER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
LC-075	COOLING TOWER REMOTE SUMP - LEVEL	FISHER 249-2500				8720	FIELD		
LCV-075	COOLING TOWER REMOTE SUMP - LEVEL	FISHER 667-ES				8702	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
LSL-076	COOLING TOWER REMOTE SUMP - LEVEL	BROOKS 652-TSWR				8728	FIELD		
LAL-076	COOLING TOWER REMOTE SUMP - LEVEL			SEE UA-1			PANEL		
LG-077	COOLING TOWER REMOTE SUMP - LEVEL	JERGUSON FIG. 146				8721	FIELD		
PI-078	COOLING TOWER PUMP DISCHARGE - PRESSURE	ASHCROFT 1279·SSL				8725	FIELD		
TEW-079	COOLING TOWER WATER AT HEAT EXCHANGER INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-079	COOLING TOWER WATER AT HEAT EXCHANGER INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-080	COOLING TOWER WATER AT HEAT EXCHANGER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-080	COOLING TOWER WATER AT HEAT EXCHANGER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
PI-081	PLANT COOLING WATER CIRCULATING PUMP DISCH. - PRESSURE	ASHCROFT 1279-SSL				8725	FIELD		
TI-082	PLANT COOLING WATER HEADER - TEMPERATURE	ASHCROFT 30AI + 38S75T				8727	FIELD		
TIC-083	PLANT COOLING WATER HEADER - TEMPERATURE	FISHER 4196C				8719	FIELD		
TCV-083	PLANT COOLING WATER HEADER - TEMPERATURE	FISHER 667-ES 3582				8702	FIELD		
PI-084	PLANT COOLING WATER HEADER - PRESSURE	ASHCROFT 1279-SS		MOUNTED WITHIN SIGHT OF PCV-086 LOCATION		8725	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PSH-085	PLANT COOLING WATER HEADER - PRESSURE	ASHCROFT B424S				8723	FIELD		
PSL-085		ASHCROFT B424S				8723	FIELD		
PAH-085				SEE UA-1			PANEL		
PAL-085	PLANT COOLING WATER HEADER - PRESSURE			SEE UA-1			PANEL		
PCV-086	PLANT COOLING WATER HEADER - PRESSURE	FISHER 667-ES				8702	FIELD		
PC-086	PLANT COOLING WATER HEADER - PRESSURE	FISHER 4195 BFE				8722	FIELD		
TEW-087	PLANT COOLING WATER AT HEAT EXCHANGER INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-087	PLANT COOLING WATER AT HEAT EXCHANGER INLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-088	PLANT COOLING WATER AT HEAT EXCHANGER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-088		THERMO-ELECTRIC				8718	FIELD		
TT-088		ROSEMOUNT 444-TKI				8717	FIELD		
TI-088	PLANT COOLING WATER AT HEAT			UI-8: PT.1 TI-088 PT.2 SPARE			PANEL		
FT-089	PLANT COOLING WATER TO FLUE GAS COOLER - FLOW	FISHER DV-2001				8710			
UJR-201	PLANT COOLING WATER TO FLUE GAS COOLER - FLOW			INPUT TO DATA LOGGER			PANEL		

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TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
TEW-090	PLANT COOLING WATER TO FLUE GAS COOLER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-090	PLANT COOLING WATER TO FLUE GAS COOLER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TEW-091	PLANT COOLING WATER AT FLUE GAS COOLER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-091		THERMO-ELECTRIC				8718	FIELD		
TT-091		ROSEMOUNT 444-TKI				8717	FIELD		
TIC-091				SEE UIC-3			PANEL		
TI-091				UI-9: PT.1: TI-091 PT.2: TI-104			PANEL		
TY-091		FISHER 546-2		I/P TRANSDUCER		8701	FIELD		
TCV-091	PLANT COOLING WATER AT FLUE GAS COOLER OUTLET - TEMPERATURE	FISHER 657-ES 3582		c/w TRAVEL STOP TO PREVENT FULL CLOSING OF VALVE		8701	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FI-092	PLANT COOLING WATER TO BED DRAIN COOLER - FLOW	BROOKS 1110				8712	FIELD		
TEW-093	PLANT COOLING WATER TO BED DRAIN COOLER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-093	PLANT COOLING WATER TO BED DRAIN COOLER - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TEW-094	PLANT COOLING WATER AT BED DRAIN COOLER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-094	PLANT COOLING WATER AT BED DRAIN COOLER OUTLET - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TEW-095	PLANT COOLING WATER TO BAYONET COOLING TUBES - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-095	PLANT COOLING WATER TO BAYONET COOLING TUBES - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FT-096	PLANT COOLING WATER TO BAYONET TUBE NO. 1 - FLOW	FISHER DV-2001				8710	FIELD		
	↓								
	↓								
UJR-201	PLANT COOLING WATER TO BAYONET TUBE NO. 1 - FLOW			INPUT TO DATA LOGGER			PANEL		
TEW-097	PLANT COOLING WATER FROM BAYONET TUBE NO. 1 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-097	PLANT COOLING WATER FROM BAYONET TUBE NO. 1 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
FT-098	PLANT COOLING WATER TO BAYONET TUBE NO. 2 - FLOW	FISHER DV-2001				8711	FIELD		
	↓								
	↓								
UJR-201	PLANT COOLING WATER TO BAYONET TUBE NO. 2 - FLOW			INPUT TO DATA LOGGER			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-099	PLANT COOLING WATER FROM BAYONET TUBE NO. 2	THERMO-ELECTRIC				8718	FIELD		
TE-099	PLANT COOLING WATER FROM BAYONET TUBE NO. 2	THERMO-ELECTRIC				8718	FIELD		
FT-100	PLANT COOLING WATER TO BAYONET TUBE NO. 3 - FLOW	FISHER DV-2001				8711	FIELD		
UJR-201	PLANT COOLING WATER TO BAYONET TUBE NO. 3 - FLOW			INPUT TO DATA LOGGER			PANEL		
TEW-101	PLANT COOLING WATER FROM BAYONET TUBE NO. 3 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-101	PLANT COOLING WATER FROM BAYONET TUBE NO. 3	THERMO-ELECTRIC				8718	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FT-102	PLANT COOLING WATER TO BAYONET TUBE NO. 4 - FLOW	FISHER DV-2001				8711	FIELD		
UJR-201	PLANT COOLING WATER TO BAYONET TUBE NO. 4 - FLOW			INPUT TO DATA LOGGER			PANEL		
TEW-103	PLANT COOLING WATER FROM BAYONET TUBE NO. 4 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-103	PLANT COOLING WATER FROM BAYONET TUBE NO. 4 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		

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A	0243		8401	0

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
TEW-104	PLANT COOLING WATER FROM BAYONET TUBES - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-104		THERMO-ELECTRIC				8718	FIELD		
TT-104		ROSEMOUNT 444-TKI				8717	FIELD		
TIC-104				SEE UIC-3			PANEL		
TI-104				UI-9: PT. 1: TI-091 PT. 2: TI-104			PANEL		
TY-104		FISHER 546-2		I/P TRANSDUCER		8701	FIELD		
TCV-104	PLANT COOLING WATER FROM BAYONET TUBES - TEMPERATURE	FISHER 657-ES 358Z				8701	FIELD		
ST-105	BED DRAIN SCREW CONVEYOR - SPEED		WITH DRIVE				FIELD		
SI-105			WITH DRIVE				FIELD		
HC-105	BED DRAIN SCREW CONVEYOR - SPEED		WITH DRIVE	SPEED SETTING			PANEL		

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TAG NUMBER	SERVICE	MFR.	VENDOR	COMMENTS		INST SPEC	LOCATION		REV
		MODEL NO.	P.O. NO.			DWG REF	P & I D	LOOP DIA	
FI-106	PLANT COOLING WATER TO TRANSFER CONVEYOR NO.2 - FLOW	BROOKS 1110				8712	FIELD		
TEW-107	PLANT COOLING WATER TO TRANSFER CONVEYOR NO. 2 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-107	PLANT COOLING WATER TO TRANSFER CONVEYOR NO. 2 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TEW-108	PLANT COOLING WATER FROM TRANSFER CONVEYOR NO. 2 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TE-108	PLANT COOLING WATER FROM TRANSFER CONVEYOR NO. 2 - TEMPERATURE	THERMO-ELECTRIC				8718	FIELD		
TI-109	PLANT COOLING WATER FROM TRANSFER CONVEYOR NO. 2 - TEMPERATURE	ASHCROFT 30A1 + 393 75T				8727	FIELD		
TI-110	PLANT COOLING WATER FROM BED DRAIN COOLER - TEMPERATURE	ASHCROFT 30A1 + 395 75T				8727	FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
FSL-111	PLANT COOLING WATER FROM BAYONET TUBE NO. 1 - FLOW	DELAVAL GEMS FS-200				8729	FIELD		
FAL-111	PLANT COOLING WATER FROM BAYONET TUBE NO 1 - FLOW			SEE LIA-1			PANEL		
FSL-112	PLANT COOLING WATER FROM BAYONET TUBE NO. 2 - FLOW	DELAVAL GEMS FS-200				8729	FIELD		
FAL-112	PLANT COOLING WATER FROM BAYONET TUBE NO. 2 - FLOW			SEE UA-1			PANEL		
FSL-113	PLANT COOLING WATER FROM BAYONET TUBE NO 3 - FLOW	DELAVAL GEMS FS-200				8729	FIELD		
FAL-113	PLANT COOLING WATER FROM BAYONET TUBE NO 3 - FLOW			SEE LIA-1			PANEL		
FSL-114	PLANT COOLING WATER FROM BAYONET TUBE NO 4 - FLOW	DELAVAL GEMS FS-200				8729	FIELD		
FAL-114	PLANT COOLING WATER FROM BAYONET TUBE NO 4 - FLOW			SEE UA-1			PANEL		

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SHT 38 OF 46

TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
ST-115	TRANSFER CONVEYOR NO. 1 - SPEED		WITH DRIVE				FIELD		
SI-115	↓		WITH DRIVE				PANEL		
HC-115	TRANSFER CONVEYOR NO. 1 - SPEED		WITH DRIVE	SPEED SETTING			PANEL		
ST-116	TRANSFER CONVEYOR NO. 2 - SPEED		WITH DRIVE				FIELD		
SI-116	↓		WITH DRIVE				PANEL		
HC-116	TRANSFER CONVEYOR NO. 2 - SPEED		WITH DRIVE	SPEED SETTING			PANEL		
KY-117	FUEL BIN ACTIVATOR - CYCLE TIME		WITH BIN ACTIVATOR	TIMER			(MCC)		
FI-118A	CYCLONE OUTLET TO RECYCLE LOOP - DIFFERENTIAL PRESS.	BROOKS 1350-8900		PURGE METER	8730		FIELD		
FI-118B	CYCLONE OUTLET TO RECYCLE LOOP - DIFFERENTIAL PRESS.	BROOKS 1350-8900		PURGE METER	8730		FIELD		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PDT-118	CYCLONE OUTLET TO RECYCLE LOOP - DIFFERENTIAL PRESS.	ROSEMOUNT 1151-DP + M4AVS				8715	FIELD		
PDI-118	CYCLONE OUTLET TO RECYCLE LOOP - DIFFERENTIAL PRESS.			UI-4: PT 1: PDI-070 PT.2: PDI-118			PANEL		
PI-119	SECONDARY AIR HEADER - PRESSURE	ASHCROFT 1279-SS				8726	FIELD		
PDSH-120	BAGHOUSE FLUE GAS -DIFF'L. PRESSURE	ASHCROFT				8723	FIELD		
PDAH-120	BAGHOUSE FLUE GAS -DIFF'L PRESSURE			SEE UA-1			PANEL		
LSH-121	COOLING TOWER REMOTE SUMP - LEVEL	BROOKS 652-TSWR				8728	FIELD		
LAH-121	COOLING TOWER REMOTE SUMP - LEVEL			SEE UA-1			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
PCV-122	INSTRUMENT TAPPING POINTS PURGE AIR - PRESSURE	FISHER 67FR		REGULATOR		8731	FIELD		
TY-123	COMBUSTOR - AVERAGE TEMPERATURE			AVERAGING			SOFTWARE		
TSH-123A	↓						SOFTWARE		
TSH-123B				INTERLOCK			SOFTWARE		
TI-123				UI-5: PT.1: PI-052 PT.2: TI-123			PANEL		
TAH-123	COMBUSTOR - AVERAGE TEMPERATURE			SEE UA-1			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
HS-124	FLYASH RECYCLE/DISPOSAL (3 WAY VALVE) CONTROL						PANEL		
EV-124				4WAY SOLENOID VALVE (SINGLE COIL)			FIELD		
XV-124				3WAY ASH DIVERTER VALVE C/W CYLINDER VALVE			FIELD		
ZS-124A				LIMIT SWITCH VALVE IN RECYCLE POSN			FIELD		
ZS-124B				LIMIT SWITCH VALVE IN DISPOSAL POSN			FIELD		
ZL-124A							PANEL		
ZL-124B	FLYASH RECYCLE/DISPOSAL (3 WAY VALVE) CONTROL						PANEL		

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INSTRUMENT LIST

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
HC-200	COMBUSTION CONTROLS	FOXBORO E27MM-SA		PLANT MASTER		8743	PANEL		
HY-200A				LOW SELECTOR			SOFTWARE		
HY-200B				HIGH SELECTOR			SOFTWARE		
HY-200C	COMBUSTION CONTROLS			HIGH SELECTOR (MINIMUM AIRFLOW LIMIT)			SOFTWARE		
UJR-201	PLANT DATA LOGGER	SUPPLY OF	IS OUT SCOPE	SEE DATALOGGER I/O LIST			PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
UIC-1	SHARED CONTROLLER	WESTINGHOUSE 1500		FOR I/O LIST SEE A-0243-9001/9002		8742	PANEL		
UIC-2	↓	WESTINGHOUSE 1500		FOR I/O LIST SEE A-0243-9003/9004		8742	PANEL		
UIC-3	SHARED CONTROLLER	WESTINGHOUSE 1500		FOR I/O LIST SEE A-0243-9005/9006		8742	PANEL		
UR-1	RECORDER: PEN1: FR-004 PEN2: FR-007 PEN3: FR-010	FOXBORO E27R-53RAG		UR-1 & 2 COME COMPLETE WITH 5 UNIT CAPACITY		8735	PANEL		
UR-2	RECORDER: PEN1: FR-023 PEN2: FR-027 PEN3: SPARE	FOXBORO E27R-53RAG		INSTRUMENT SHELF FOXBORO MODEL 2025-5		8735	PANEL		
UA-1	ANNUNCIATOR	5IOC PANALARM SERIES 90		SEE ANNUNCIATOR LAYOUT DRAWING A-0243-8501		8738	PANEL		

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INSTRUMENT LIST
(MULTI-CHANNEL SUMMARY)

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
U1-1	INDICATOR: PT.1: P1-008 PT.2: P1-043	FOXBORO E27ID-SAL		U1-1 TO 9 COME COMPLETE WITH A 10 UNIT CAPACITY INSTRUMENT SHELF FOXBORO MODEL 202S-10		8732	PANEL		
U1-2	PT.1: PDI-064 PT.2: PDI-065					8732	PANEL		
U1-3	PT.1: P1-062 PT.2: P1-066	FOXBORO E27ID-SAL				8732	PANEL		
U1-4	PT.1: PDI-070 PT.2: PDI-118	FOXBORO E27ID-SA				8732	PANEL		
U1-5	PT.1: P1-052 PT.2: TI-123					8732	PANEL		
U1-6	PT.1: TI-053 PT.2: TI-063					8732	PANEL		
U1-7	PT.1: TI-067 PT.2: SPARE					8732	PANEL		
U1-8	PT.1: TI-088 PT.2: SPARE					8732	PANEL		
U1-9	INDICATOR: PT.1: TI-091 PT.2: TI-104	FOXBORO E27ID-SA				8732	PANEL		

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TAG NUMBER	SERVICE	MFR. MODEL NO.	VENDOR P.O. NO.	COMMENTS		INST SPEC DWG REF	LOCATION P & I D	LOOP DIA	REV
UX-1	LOOP POWER SUPPLY	FOXBORO N0140AR				8741	REAR OF PANEL		
UX-1A	DISTRIBUTION PANEL FOR 10 LOOPS	FOXBORO N0140MA		LOOPS 089, 096, 098, 100, 102		8741	REAR OF PANEL		

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DWN	CHK	APP	DATE	REV
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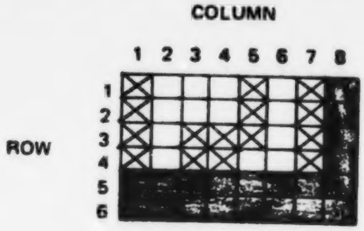

ANNUNCIATOR: 4 ROWS BY 7 COLUMNS
☐ - SINGLE POINT MODULE
☒ - TWIN POINT MODULE
ANNUNCIATOR SPEC SEE DWG. A-0243-8738

Alarm Tag No.	Legend NOTE ①	Row NOTE ②	Column	Tag No. of Contact	Notes
LAH-021	FUEL BIN HIGH LEVEL	1A	1	LSH-021	
LAL-022	FUEL BIN LOW LEVEL	1B	1	LSL-022	
FAH-024	FUEL FEEDER OVERFEED	2A	1	FSH-024	
FAL-024	FUEL FEEDER UNDERFEED	2B	1	FSL-024	
LAH-025	LIMESTONE BIN HIGH LEVEL	3A	1	LSH-025	
LAL-026	LIMESTONE BIN LOW LEVEL	3B	1	LSL-026	
FAH-028	LIMESTONE FEEDER OVERFEED	4A	1	FSH-028	
FAL-028	LIMESTONE FEEDER UNDERFEED	4B	1	FSL-028	
FAL-007	PRIMARY AIR LOW FLOW	1	2	FSL-007A	
FAL-004	TOTAL AIR LOW FLOW	2	2	FSL-004	
		3	2		SPARE
		4	2		SPARE
PAH-052	COMBUSTOR HIGH PRESSURE	1	3	PSH-052	
PAL-052	COMBUSTOR LOW PRESSURE	2	3	PSL-052	
PDAH-065	FLUIDIZED BED HIGH DIFF'L. PRESS	3A	3	PDSH-065	
PDAL-065	FLUIDIZED BED LOW DIFF'L PRESS.	3B	3	PDSL-065	
PAL-008	PRI. AIRWINDBOX LOW PRESSURE	4A	3	PSL-008	
PAL-043	FLUIDIZED BED BASE LOW PRESS.	4B	3	PSL-043	
	COMBUSTOR TRIP	1	4		
TAH-123	COMBUSTOR HIGH AVERAGE TEMPERATURE	2	4	TSH-123A	
	F.D. BLOWER MOTOR TRIP	3A	4	MCC	
	I.D. FAN MOTOR TRIP	3B	4	MCC	
	BED DRAIN CONVEYOR MOTOR TRIP	4A	4	MCC	
		4B	4		SPARE
		1A	5		SPARE
		1B	5		SPARE
		2A	5		SPARE ③
		2B	5		SPARE
		3A	5		SPARE
		3B	5		SPARE
		4	5		SPARE
TAH-068	④	1	6	TSH-068	
PDAH-120	BAGHOUSE HIGH DIFFERENTIAL PRESSURE	2	6	PDSH-120	
		3	6		SPARE
		4	6		SPARE
FAL-111	BAYONET TUBE #1 LOW FLOW	1A	7	FSL-111	
FAL-112	BAYONET TUBE #2 LOW FLOW	1B	7	FSL-112	
FAL-113	BAYONET TUBE #3 LOW FLOW	2A	7	FSL-113	
FAL-114	BAYONET TUBE #4 LOW FLOW	2B	7	FSL-114	
PAH-085	COOLING WATER HIGH PRESSURE	3A	7	PSH-085	
PAL-085	COOLING WATER LOW PRESSURE	3B	7	PSL-085	
LAH-121	REMOTE SUMP HIGH LEVEL	4A	7	LSH-121	
LAL-076	REMOTE SUMP LOW LEVEL	4B	7	LSL-076	

① FIRST LINE OF WINDOW LEGEND SHALL BE TAG NO. OF ALARM
② SUFFIX -A ... TOP HALF OF TWIN MODULE -B... BOTTOM HALF OF TWIN MODULE
③ RESERVED FOR FLUE GAS ANALYSIS ALARMS
④ FLUE GAS COOLER GAS OUTLET HIGH TEMPERATURE

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ANNUNCIATOR LAYOUT
INSTRUMENT SPECIFICATION

A | 0243 | | 8501 | 0

INPUT TAG NO.	SIGNAL RANGE + UNITS	ENGINEERING UNITS	TERMINALS BANK	NO.S		ALARM SETPOINT HIGH	LOW	SIGNAL PROCESSING	REMARKS
TT-003	4-20 mADC	0-100 °C	2	9 +	9 -				
FY-017A	0-10 VDC	0-80 kg/hr	2	10 +	10 -				UIC-3 SIGNAL SOURCE
FY-018A	0-10 VDC	0-160 kg/hr	2	11 +	11 -				UIC-3 SIGNAL SOURCE
TI -030		200-1200 °C	1	1 +	1 -				
TI -031			1	2 +	2 -				
TI -032			1	3 +	3 -				
TI -033			1	4 +	4 -				
TI -034			1	5 +	5 -				
TI -035			1	6 +	6 -				
① TI -036			1	7 +	7 -				
TI -037			1	8 +	8 -				
TI -038			1	9 +	9 -				
TI -039			1	10 +	10 -				
TI -040			1	11 +	11 -				
TI -041			1	12 +	12 -				
TI -042		200-1200 °C	1	13 +	13 -				
TT -053	4-20 mADC	200-1200 °C	1	14 +	14 -				
TE -055	0-50 mV	200-1200 °C	1	15 +	15 -			A	TYPE K TH.CPL
TE -057	0-50 mV	200-1200 °C	1	16 +	16 -			A	TYPE K TH.CPL.
TE -060	0-50 mV	200-1200 °C	2	1 +	1 -			A	TYPE K TH.CPL
TT -063	4-20mADC	400-1000 °C	2	2 +	2 -				
TT -067	4-20 mADC	100-300° C	2	3 +	3 -				
TE -072	0-12 mV	100-300° C	2	4 +	4 -			A	TYPE K TH.CPL.
TE -074	0-1 mV	0-30° C	2	16 +	16 -			A	TYPE K TH CPL
TE -079	0-2 mV	0-50° C	3	1 +	1 -			A	TYPE K TH.CPL
TE -080	0-3 mV	0-80° C	3	2 +	2 -			A	TYPE K TH.CPL.
TE -087	0-2 mV	0-50° C	3	3 +	3 -			A	TYPE K TH.CPL.
TT-088	4-20mADC	0-100° C	3	4 +	4 -				

SIGNAL PROCESSING:

A - TYPE K THERMOCOUPLE LINEARIZATION

B - SQUARE ROOT EXTRACTION

C - TOTALIZATION

① 9 INPUTS ARE TYPE K THERMOCOUPLE, 3 ARE 4-20mADC (TO BE SELECTED LATER)

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DATA LOGGER I/O LIST
(INPUTS)

A	0243		8601	0

INPUT TAG NO.	SIGNAL RANGE + UNITS	ENGINEERING UNITS	TERMINALS BANK	TERMINALS NO.S		ALARM SETPOINT HIGH	ALARM SETPOINT LOW	SIGNAL PROCESSING	REMARKS
FT-089	4-20mADC	0-180 L/min	3	12+	12-				
TT-091	4-20mADC	0-100 °C	3	5+	5-				
TE-094	0-4 mV	0-100 °C	3	6+	6-			A	TYPE K TH.CPL.
FT-096	4-20mADC	0-80 L/min	3	13+	13-				
TE-097	0-4mV	0-100 °C	3	8+	8-			A	TYPE K TH.CPL.
FT-098	4-20mADC	0-80 L/min	3	14+	14-				
TE-099	0-4 mV	0-100 °C	3	9+	9-			A	TYPE K TH.CPL.
FT-100	4-20mADC	0-80 L/min	3	15+	15-				
TE-101	0-4 mV	0-100 °C	3	10+	10-			A	TYPE K TH.CPL.
FT-102	4-20mADC	0-80 L/min	3	16+	16-				
TE-103	0-4 mV	0-100 °C	3	11+	11-			A	TYPE K TH.CPL.
TE-108	0-3 mV	0-80° C	3	7+	7-			A	TYPE K TH.CPL.

SIGNAL PROCESSING:

A - TYPE K THERMOCOUPLE LINEARIZATION
B - SQUARE ROOT EXTRACTION
C - TOTALIZATION

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DATA LOGGER I/O LIST
(INPUTS)

A	0243		8602	0

GENERAL	1.	TAG NUMBER			TCV-091			TCV-104			
	2.	SERVICE			COOL. WTR FROM FLUE			COOL. WTR. FROM			
					GAS COOLER-TEMP.			BAYONET TUBES-TEMP			
	3.	LINE OR VESSEL									
	4.	LINE SIZE/SCHED.: INLET			30mm ($1\frac{1}{4}$")			40mm ($1\frac{1}{2}$")			
	5.	: OUTLET			30mm ($1\frac{1}{4}$")			40mm ($1\frac{1}{2}$")			
BODY	6.	BODY TYPE			GLOBE			GLOBE			
	7.	BODY SIZE	PORT SIZE		25mm (1")	$1\frac{5}{16}$"		25mm (1")	$1\frac{5}{16}$"		
	8.	GUIDING	NO. OF PORTS		CAGE	1		CAGE	1		
	9.	END CONN. & RATING			SCR'D NPT			SCR'D NPT			
	10.	BODY MATERIAL			CARBON STEEL			CARBON STEEL			
	11.	PACKING MATERIAL			TFE			TFE			
	12.	LUBRICATOR	ISOLATING VALVE		—	—		—	—		
	13.	BONNET TYPE			STD.			STD.			
	14.	TRIM: FORM (TRIM NO.)			EQ. PERC. (#1)			EQ. PERC. (#1)			
	15.	: MATERIAL-SEAT/PLUG			416 SS			416 SS			
	16.	: -SHAFT			STD			STD.			
	17.	MAX. LEAKAGE: ANSI CLASS									
	18.	MAX. ALLOW. SOUND @ 1m: dBA									
ACTUATOR	19.	MODEL NO. & SIZE			657 - 34			657 - 34			
	20.	TYPE			DIAPHRAGM			DIAPHRAGM			
	21.	CLOSE AT	OPEN AT kPa		200	40		200	40		
	22.	FLOW ACTION TO									
	23.	FAIL POSITION			OPEN			OPEN			
	24.	HANDWHEEL AND LOCATION			—			—			
POSITIONER	25.	MFR. & MODEL NO. FISHER			3582 C			3582 C			
	26.	FILTER REG.	GAUGES	BYPASS	YES	—	—	YES	—	—	
	27.	INPUT SIGNAL kPa			20-100			20-100			
	28.	OUTPUT SIGNAL kPa			40-200			40-200			
	29.	AIR SUPPLY PRESSURE kPa			240			240			
TRANSDUCER	30.	MAKE & MODEL NO. FISHER			546-2			546-2			
	31.	INPUT SIGNAL mA			4-20			4-20			
	32.	OUTPUT SIGNAL kPa			20-100			20-100			
OPTIONS	33.	TRANSDUCER TAG NO.			TY-091			TY-104			
	34.	50 mm PIPESTAND MTG.			MTG-58			MTG-58			
	35.	AIRSET SET @ 140 kPa			67-FR-362			67-FR-362			
SERVICE	36.	CONDITIONS:									
	37.	FLUID			WATER			WATER			
	38.	QUANT.: MAX	Cv		156	10.2		217	11.2		
	39.	: NORM.	Cv		99	6.4		189	9.5		
	40.	VALVE Cv	F_L		17.4			17.4			
	41.	PRESS. - NORMAL	INLET	ΔP		110			190		
	42.	- MAX.	INLET		620			620			
	43.	- MAX. SHUT OFF ΔP			620			620			
	44.	TEMP. - MAX.	NORMAL			66			66		
	45.	REL. DENSITY	MOL. WT.		.98			.98			
	46.	VISCOSITY	% FLASH								
	47.	% SUPERHEAT	% SOLIDS								
	48.	VAPOR PRESS.	CRIT. PRESS.		26			26			
	49.	PREDICTED SOUND LEVEL dBA									
	50.	UNITS -									
		QUANTITY	PRESS.	TEMP.	L/min	kPa	°C	L/min	kPa	°C	
	51.	NOTE(S)			SEE NOTE ①						
	52.	MANUFACTURER			FISHER			FISHER			
	53.	MODEL NO.			25mm (1") ES-			25mm (1") ES-			
					657-34			657-34			

NOTES: ① TRAVEL STOP: DOWN STOP TO PREVENT VALVE FULLY CLOSING

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CONTROL VALVES
INSTRUMENT SPECIFICATION

A	0243		8701	0

					① Ⓐ		②	
GENERAL	1.	TAG NUMBER	LCV-075		TCV-083		PCV-086	
	2.	SERVICE	COOLING TWR. REMOTE SUMP-LEVEL		COOLING WATER HDR - TEMPERATURE		PLANT COOLING WTR HEADER - PRESS	
	3.	LINE OR VESSEL						
	4.	LINE SIZE/SCHED.: INLET	25mm (1")				50mm (2")	
	5.	: OUTLET	25mm (1")				50mm (2")	
BODY	6.	BODY TYPE	GLOBE		GLOBE		GLOBE	
	7.	BODY SIZE / PORT SIZE	25mm (1")	1"	40mm (1½")	1⅞"	25mm (1")	½"
	8.	GUIDING / NO. OF PORTS	CAGE	1	CAGE	1	CAGE	1
	9.	END CONN. & RATING	SCR'D NPT		SCR'D NPT		SCR'D NPT	
	10.	BODY MATERIAL	CARBON STEEL		CARBON STEEL		CARBON STEEL	
	11.	PACKING MATERIAL	TFE		TFE		TFE	
	12.	LUBRICATOR / ISOLATING VALVE	–	–	–	–	–	–
	13.	BONNET TYPE	STD.		STD		STD	
	14.	TRIM: FORM (TRIM NO.)	MICROFORM (#1)		LINEAR (#1)		MICROFORM (#1)	
	15.	: MATERIAL - SEAT/PLUG	416 SS		416 SS		416 SS	
	16.	: - SHAFT	STD.		STD.		STD	
	17.	MAX. LEAKAGE: ANSI CLASS						
	18.	MAX. ALLOW. SOUND @ 1m: dBA						
ACTUATOR	19.	MODEL NO. & SIZE	667-34		667-34		667-30	
	20.	TYPE	DIAPHRAGM		DIAPHRAGM		DIAPHRAGM	
	21.	CLOSE AT / OPEN AT kPa	20	100	40	200	20	100
	22.	FLOW ACTION TO						
	23.	FAIL POSITION	CLOSED		CLOSED		CLOSED	
	24.	HANDWHEEL AND LOCATION	–					
POSITIONER	25.	MFR. & MODEL NO. FISHER			3582 C			
	26.	FILTER REG. / GAUGES / BYPASS			YES – –			
	27.	INPUT SIGNAL kPa			20-100			
	28.	OUTPUT SIGNAL kPa			40-200			
	29.	AIR SUPPLY PRESSURE kPa			240			
TRANSDUCER	30.	MAKE & MODEL NO.						
	31.	INPUT SIGNAL						
	32.	OUTPUT SIGNAL						
OPTIONS	33.							
	34.							
	35.							
SERVICE	36.	CONDITIONS:						
	37.	FLUID	WATER		WATER		WATER	
	38.	QUANT.: MAX / Cv						
	39.	: NORM. / Cv	76	5.2	174	26.5	90	3.2
	40.	VALVE Cv / FL	12.2		34.9		5.32	
	41.	PRESS. - NORMAL INLET / ΔP	210	100	103	21	620	400
	42.	- MAX. INLET						
	43.	- MAX. SHUT OFF ΔP	210		103		620	
	44.	TEMP. - MAX. / NORMAL		16		66		29
	45.	REL. DENSITY / MOL. WT.	1.0		0.98		1.0	
	46.	VISCOSITY / % FLASH						
	47.	% SUPERHEAT / % SOLIDS						
	48.	VAPOR PRESS. / CRIT. PRESS.						
	49.	PREDICTED SOUND LEVEL dBA						
	50.	UNITS - QUANTITY / PRESS. / TEMP.	L/min	kPa °C	L/min	kPa °C	L/min	kPa °C
	51.	NOTE(S)						
	52.	MANUFACTURER	FISHER		FISHER		FISHER	
	53.	MODEL NO.	25mm (1") ES		40mm (1½") ES		25mm (1") ES	
			667-34		667-34		667-34	

NOTES: ① TCV-083 IS VERY PRELIMINARY Ⓐ REVISED FOR FINAL REPORT
② PCV-086 IS VERY PRELIMINARY AND WAS ADDED AFTER INQUIRY WAS ISSUED

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CONTROL VALVES
INSTRUMENT SPECIFICATION

A	0243		8702	A

GENERAL	1.	**TAG NUMBER**	FCV-017			FCV-018			PCV-052		
	2.	**SERVICE**	LOOP SEAL AIR			FLYASH RECYCLE			COMBUSTOR		
			- FLOW			AIR - FLOW			- PRESSURE		
	3.	**LINE OR VESSEL**									
	4.	**LINE SIZE/SCHED.: INLET**	50mm (2")			25mm (1")			200mm (8")		
	5.	**: OUTLET**	50mm (2")			25mm (1")			200mm (8")		
BODY	6.	**BODY TYPE**	GLOBE			GLOBE			BUTTERFLY		
	7.	**BODY SIZE PORT SIZE**	25mm (1")	1"		25mm (1")	1 5/16"		200mm		
	8.	**GUIDING NO. OF PORTS**	CAGE	1		CAGE	1		SHAFT	1	
	9.	**END CONN. & RATING**	SCR'D NPT			SCR'D NPT			NOTE ①		
	10.	**BODY MATERIAL**	CARBON STEEL			CARBON STEEL			CARBON STEEL		
	11.	**PACKING MATERIAL**	TFE			TFE			TBA		
	12.	**LUBRICATOR ISOLATING VALVE**	—	—		—	—		—	—	
	13.	**BONNET TYPE**	STD.			STD			STD		
	14.	**TRIM: FORM** (TRIM NO.)	MICROFORM (#1)			LINEAR (#1)			FISH TAIL ⑤		
	15.	**: MATERIAL-SEAT/PLUG**	416 SS			416 SS			316 SS		
	16.	**: -SHAFT**	STD			STD.			STD.		
	17.	**MAX. LEAKAGE: ANSI CLASS**									
	18.	**MAX. ALLOW. SOUND @ 1m: dBA**	85			85			85		
ACTUATOR	19.	**MODEL NO. & SIZE**	657-34			667-30			1051 -		
	20.	**TYPE**	DIAPHRAGM			DIAPHRAGM			DIAPHRAGM		
	21.	**CLOSE AT OPEN AT** kPa	100	20		40	200		40	200	
	22.	**FLOW ACTION TO**									
	23.	**FAIL POSITION**	OPEN			CLOSED			OPEN		
	24.	**HANDWHEEL AND LOCATION**	—			—			—		
POSITIONER	25.	**MFR. & MODEL NO.** FISHER				3582C			3511		
	26.	**FILTER REG. GAUGES BYPASS**				YES	–	–	YES		–
	27.	**INPUT SIGNAL** kPa				20-100			20-100		
	28.	**OUTPUT SIGNAL** kPa				40-200			40-200		
	29.	**AIR SUPPLY PRESSURE** kPa				240			240		
TRANSDUCER	30.	**MAKE & MODEL NO.** FISHER	546-2			546-2			546-2		
	31.	**INPUT SIGNAL** mA	4-20			4-20			4-20		
	32.	**OUTPUT SIGNAL** kPa	20-100			20-100			20-100		
OPTIONS	33.	TRANSDUCER TAG. NO	FY-017 B			FY-018 B			PY-052		
	34.	50 mm PIPESTAND MOUNTING	HARDWARE INCL			HARDWARE INCL			HARDWARE INCL		
	35.	AIRSET SET @ 140 kPa	67FR-362			67FR-362			67FR-362		
SERVICE	36.	**CONDITIONS:**									
	37.	**FLUID**	AIR			AIR			FLUE GAS ④		
	38.	**QUANT.: MAX** Cv Cg	2285	340		4560	320		49100	20600	
	39.	**: NORM.** Cv Cg	1450	216		3840	390				
	40.	**VALVE** Cv Cg **Fx** Ci	467	38.2		668	33.2		39100	27.2	
	41.	**PRESS. - NORMAL INLET ΔP**	64.8	6.5		67	16.4		-5.8	1.00	
	42.	**- MAX. INLET**	83			83					
	43.	**- MAX. SHUT OFF ΔP**	83			83			10		
	44.	**TEMP. - MAX. NORMAL**		66			66		260	177	
	45.	**REL. DENSITY MOL. WT.**	1.0	29.0		1.0	29.0		⑥		
	46.	**VISCOSITY % FLASH**									
	47.	**% SUPERHEAT % SOLIDS**									
	48.	**VAPOR PRESS. CRIT. PRESS.**									
	49.	**PREDICTED SOUND LEVEL dBA**									
	50.	**UNITS -**									
		QUANTITY PRESS. TEMP.	②	kPa	°C	②	kPa	°C	②	kPa	°C
	51.	**NOTE(S)**							③		
	52.	**MANUFACTURER**	FISHER			FISHER			FISHER		
	53.	**MODEL NO.**	25mm (1") ES-			25mm (1") ES-			200mm (8") 7600		
			657-34			667-30			1051-3511		

NOTES:

① VALVE MOUNTS BETWEEN ANSI 150 LB. FLANGES
② SCFH (101.3 kPa ABSOLUTE, 15.6 °C)
③ LINE BOLTING TO BE INCLUDING
④ FLUE GAS: DUST LOADING 75-123 GRAM/m^3 @ 101.3 kPa, 15.6°C
⑤ BUSHINGS - GRAPHITE FILLED BRONZE
⑥ DENSITY = 0.809 kg/ACTUAL m^3 = 1.338 kg/m^3 @ 101.3 kPa, 15.6°C = 1.09 RELATIVE DENSITY (1.00 = AIR)

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CONTROL VALVES
INSTRUMENT SPECIFICATION

A	0243		8703	0

GENERAL	1.	TAG NUMBER		PCV-002		FCV-004		FCV-010	
	2.	SERVICE		COMBUSTION AIR HEADER - PRESS.		TOTAL AIR TO COMBUSTOR - FLOW		SECONDARY AIR - FLOW	
	3.	LINE OR VESSEL							
	4.	LINE SIZE/SCHED.: INLET mm		150		150		100	
	5.	: OUTLET mm		150		150		100	
BODY	6.	BODY TYPE		BUTTERFLY		BUTTERFLY		BUTTERFLY	
	7.	BODY SIZE	PORT SIZE	80mm (3")		80mm (3")		80mm (3")	
	8.	GUIDING	NO. OF PORTS	SHAFT	1	SHAFT	1	SHAFT	1
	9.	END CONN. & RATING		NOTE ①		NOTE ①		NOTE ①	
	10.	BODY MATERIAL		CARBON STEEL		CARBON STEEL		CARBON STEEL	
	11.	PACKING MATERIAL		TFE		TFE		TFE	
	12.	LUBRICATOR	ISOLATING VALVE	—	—	—	—	—	—
	13.	BONNET TYPE		STD.		STD.		STD.	
	14.	TRIM: FORM		FISH TAIL		FISH TAIL		FISH TAIL	
	15.	: MATERIAL - SEAT/PLUG		316 SS		316 SS		316 SS	
	16.	: - SHAFT		STD.		STD.		STD.	
	17.	MAX. LEAKAGE: ANSI CLASS							
	18.	MAX. ALLOW. SOUND @ 1m: dBA		85		85		85	
ACTUATOR	19.	MODEL NO. & SIZE		1051 - 30		1051 - 30		1051 - 30	
	20.	TYPE		DIAPHRAGM		DIAPHRAGM		DIAPHRAGM	
	21.	CLOSE AT	OPEN AT	40	200	200	40		
	22.	FLOW ACTION TO							
	23.	FAIL POSITION		CLOSED		OPEN		OPEN	
	24.	HANDWHEEL AND LOCATION		—		—		—	
POSITIONER	25.	MFR. & MODEL NO. FISHER		3511		3511		3511	
	26.	FILTER REG.	GAUGES BYPASS	YES	— —	YES	— —	YES	— —
	27.	INPUT SIGNAL kPa		20-100		20-100		20-100	
	28.	OUTPUT SIGNAL kPa		40-200		40-200		40-200	
	29.	AIR SUPPLY PRESSURE kPa		240		240		240	
TRANSDUCER	30.	MAKE & MODEL NO. FISHER		546-2		546-2		546-2	
	31.	INPUT SIGNAL mA		4-20		4-20		4-20	
	32.	OUTPUT SIGNAL kPa		20-100		20-100		20-100	
OPTIONS	33.	TRANSDUCER TAG NO.		PY-002		FY-005C		FY-010C	
	34.	50 mm PIPESTAND MTG.		HARDWARE INCL.		HARDWARE INCL		HARDWARE INCL.	
	35.	AIRSET SET @ 140 kPa		67FR-362		67FR-362		67FR-362	
SERVICE	36.	CONDITIONS:							
	37.	FLUID		AIR		AIR		AIR	
	38.	QUANT.: MAX	~~Cv~~ Cg	40600	1990	46400	⑤		
	39.	: NORM.	~~Cv~~ Cg	18900	940	27600	1700	14500	1920
	40.	VALVE ~~Cv~~ Cg	~~Ft~~ C_1	③	28.6/31	③	30.1	④	28.8
	41.	PRESS. - NORMAL INLET	ΔP	69	55	65	27	36.1	5.5
	42.	- MAX. INLET		83		83		83	
	43.	- MAX. SHUT OFF ΔP		83		83		83	
	44.	TEMP. - MAX.	NORMAL		66		66		66
	45.	REL. DENSITY	MOL. WT.	1.0	29.0	1.0	29.0	1.0	29.0
	46.	VISCOSITY	% FLASH						
	47.	% SUPERHEAT	% SOLIDS						
	48.	VAPOR PRESS.	CRIT. PRESS.						
	49.	PREDICTED SOUND LEVEL dBA							
	50.	UNITS -							
		QUANTITY	PRESS. TEMP.	②	kPa °C	②	kPa °C	②	kPa °C
	51.	NOTE(S)							
	52.	MANUFACTURER		FISHER		FISHER		FISHER	
	53.	MODEL NO.		80mm (3") 9500		80mm (3") 9500		80mm (3") 9500	
				1051 - 40		1051 - 40		1051 - 40	

NOTES:

① VALVE MOUNTS BETWEEN ANSI 150 LB. FLANGES.

② SCFH (101.3 kPa ABSOLUTE, 15.6 °C)

③ VALVE $C_g = 3680 \times .93 = 3422$

④ VALVE $C_g = 3680 \times .94 = 3459$

⑤ MAX. CONDITIONS: $P_1 = 81$ kPa, $\Delta P = 12.4$ kPa $C_1 = 24.3$ $C_g = 3250$

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CONTROL VALVES
INSTRUMENT SPECIFICATION

A	0243		8704	0

	TAG NUMBER	FE-004		FO-006			
PIPING	SIZE & SCHEDULE	150mm (6") Sch 40		150mm (6") Sch 40			
	UPSTREAM - DIAMETERS						
	DOWNSTREAM - DIAMETERS						
	INSIDE DIAMETER	154mm (6.065")		154mm (6.065")			
EQUIPT.	ELEMENT ONLY						
	ELEMENT & HOLDER	YES		YES			
	COMPLETE METERING RUN						
ELEMENT	TYPE: ORIFICE OR OTHER	ORIFICE		ORIFICE			
	MOUNTING METHOD	SEE HOLDER		SEE HOLDER			
	MATERIAL	316SS		316 SS			
	THICKNESS	3.175mm (1/8")		3.175mm (1/8")			
	BORE NOTE ①						
	d/D (β) RATIO NOTE ①	0.595		0.259			
	ORIFICE: TAB TYPE, CONCENTRIC	YES		TO SUIT HOLDER			
	DRAIN HOLE	YES					
HOLDER	MATERIAL	CARBON STEEL		CARBON STEEL			
	RATING	300 LB. ANSI		600 LB ANSI			
	LINE MOUNTING METHOD	WELDNECK		WELDNECK			
	TAP STYLE	FLANGE TAPS					
	TAP FITTINGS: SIZE & TYPE	1/2" NPT		1/2" NPT			
		NOTE ②		NOTE ⑤			
ACCESSORIES	STRAIGHTENING VANES - TUBE BUNDLE TYPE COMPLETE WITH FLANGE RING ⑦	YES					
	- TAG NO.	Fx-004					
	- MATERIAL	CARBON STEEL					
PROCESS	FLUID	AIR		AIR			
	MAXIMUM ΔP (SIZING)	3.00 kPa		NOTE ④			
	FLOW @ ΔP SIZING	1600 kg/hr ③		454 kg/hr ⑥			
FLUID	FLOW: DESIGN MAX.	958	1600	454			
	PRESSURE: DESIGN MAX.	69.0	83	36.9			
	TEMPERATURE: DESIGN MAX.	66		66			
	VISCOSITY @ NORMAL FLOW						
	RELATIVE DENSITY @ NORMAL FLOW	1.00 AIR		1.00 AIR			
	STEAM QUALITY						
	FLOW UNITS	kg/hr		kg/hr			
	PRESSURE UNITS	kPa		kPa			
	TEMP. UNITS	°C		°C			
	SERVICE	PRIMARY + SECONDARY AIR-FLOW		PRIMARY AIR-FLOW			

NOTES

① BETA RATIO CALCULATION IS APPROXIMATE ONLY. VENDOR TO SUPPLY PRECISE CALCULATION AND BORE SIZE.

② ORIFICE FLANGES COMPLETE WITH: STUD BOLTS, HEX NUTS, JACKSCREWS, PIPEPLUGS FOR TAPS, SET OF GASKETS

③ 1600 kg/hr = 46069 SCFH (101.3 kPa, 15.6 °C)

④ TO BE SIZED FOR AN UNRECOVERED ΔP OF 10.7 kPa (RESTRICTION ORIFICE)

⑤ DANIEL SIMPLEX ORIFICE PLATE HOLDER MODEL 705-DS OR EQUAL

⑥ 454 kg/hr = 13058 SCFH (101.3 kPa, 15.6 °C)

⑦ TO SUIT ANSI 150 lb FLANGES

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FLOW ELEMENTS

INSTRUMENT SPECIFICATION

A	0243		8705	

	TAG NUMBER	FE-010			FE-017		FE-018	
PIPING	SIZE & SCHEDULE	100mm (4") Sch.40			25mm (1") Sch.40		40mm (1½") Sch40	
	UPSTREAM - DIAMETERS				30		30	
	DOWNSTREAM - DIAMETERS				5		5	
	INSIDE DIAMETER	102.3mm (4.026")			26.6mm (1.049")		40.9mm (1.610")	
EQUIPT.	ELEMENT ONLY							
	ELEMENT & HOLDER	YES						
	COMPLETE METERING RUN				YES NOTE ⑤		YES NOTE ⑤	
ELEMENT	TYPE: ORIFICE OR OTHER	ORIFICE			ORIFICE		ORIFICE	
	MOUNTING METHOD	SEE HOLDER			SEE HOLDER		SEE HOLDER	
	MATERIAL	316 SS			316 SS		316 SS	
	THICKNESS	3.175mm (1/8")			3.175mm (1/8")		3.175mm (1/8")	
	BORE NOTE ①							
	d/D (β) RATIO NOTE ①	0.679			0.658		0.650	
	ORIFICE: CONCENTRIC, TAB TYPE	YES			YES		YES	
	DRAIN HOLE	YES			YES		YES	
HOLDER	MATERIAL	CARBON STEEL			CARBON STEEL		CARBON STEEL	
	RATING	300 LB ANSI			300 LB. ANSI		300 LB. ANSI	
	LINE MOUNTING METHOD	WELDNECK			WELDNECK		WELDNECK	
	TAP STYLE	FLANGE TAPS			FLANGE TAPS		FLANGE TAPS	
	TAP FITTINGS: SIZE & TYPE	1/2" NPT NOTE ②			½" NPT		½" NPT	
ACCESSORIES	STRAIGHTENING VANES							
	GASKETS, STUDS & NUTS							
PROCESS	FLUID	AIR			AIR		AIR	
	MAXIMUM △P (SIZING)	4.5 kPa			6 kPa		4.5 kPa	
	FLOW @ △P SIZING	1000 kg/hr ③			80 kg/hr ⑥		160 kg/hr ⑦	
FLUID	FLOW: DESIGN MAX.	504	1000		50	80	133	160
	PRESSURE: DESIGN MAX.	36.9	36.9		68.3	68.3	68.3	68.3
	TEMPERATURE: DESIGN MAX.	66			66		66	
	VISCOSITY @ NORMAL FLOW							
	RELATIVE DENSITY @ NORMAL FLOW	1.00 AIR			1.00 AIR		1.00 AIR	
	STEAM QUALITY							
	FLOW UNITS	kg/hr			kg/hr		kg/hr	
	PRESSURE UNITS	kPa			kPa		kPa	
	TEMP. UNITS	°C			°C		°C	
	SERVICE	SECONDARY AIR - FLOW			LOOP SEAL AIR - FLOW		FLY ASH RECYCLE AIR - FLOW	

NOTES

① BETA RATIO CALCULATION IS APPROXIMATE ONLY. VENDOR TO SUPPLY PRECISE CALCULATION AND BORE SIZE

② ORIFICE FLANGES COMPLETE WITH: STUD BOLTS, HEX NUTS, JACKSCREWS, PIPE PLUGS FOR TAPS, SET OF GASKETS

③ 1000 kg/hr = 28793 SCFH (101.3 kPa, 15.6°C)

④

⑤ A COMPLETE AND ASSEMBLED METERING RUN SHALL BE SUPPLIED WITH AT LEAST THE LENGTH OF UPSTREAM AND DOWNSTREAM PIPING SPECIFIED. METERING TUBE ENDS SHALL BE THREADED MALE NPT.

⑥ 80 kg/hr = 2303 SCFH (101.3 kPa, 15.6°C)

⑦ 160 kg/hr = 4607 SCFH (101.3 kPa, 15.6°C)

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FLOW ELEMENTS
INSTRUMENT SPECIFICATION

A	0243		8706	0

ABANDONED ALTERNATIVE TO ROTAMETERS ON 8739-8740

	TAG NUMBER	FE-011	FE-012	FE-013	FE-014
PIPING	SIZE & SCHEDULE	50mm (2") Sch. 40			
	UPSTREAM - DIAMETERS	7 MINIMUM			
	DOWNSTREAM - DIAMETERS	3 MINIMUM			
	INSIDE DIAMETER	52.5 mm (2.067")			
EQUIPT.	ELEMENT ONLY	YES			
	ELEMENT & HOLDER				
	COMPLETE METERING RUN				
ELEMENT	TYPE: ORIFICE OR OTHER	ANNUBAR			
	MOUNTING METHOD	COUPLING			
	MATERIAL	316 SS			
	THICKNESS	—			
	BORE	—			
	d/D (β) RATIO	—			
	INSTRUMENT CONNECTIONS	NOTE ①	SPECIFICATION IDENTICAL TO FE-011	SPECIFICATION IDENTICAL TO FE-011	SPECIFICATION IDENTICAL TO FE-011
HOLDER	MATERIAL				
	RATING				
	LINE MOUNTING METHOD				
	TAP STYLE				
	TAP FITTINGS: SIZE & TYPE				
ACCESSORIES	STRAIGHTENING VANES				
	GASKETS, STUDS & NUTS				
	MOUNTING HARDWARE	COUPLING INCL.			
	- MAT'L	CARBON STEEL			
PROCESS	FLUID	AIR			
	MAXIMUM Δ P (SIZING)	NOTE ②			
	FLOW @ Δ P SIZING	NOTE ②			
FLUID	FLOW: DESIGN MAX.	100 500			
	PRESSURE: DESIGN MAX.	29.9			
	TEMPERATURE: DESIGN MAX.	66			
	VISCOSITY @ NORMAL FLOW				
	RELATIVE DENSITY @ NORMAL FLOW	1.00 AIR			
	STEAM QUALITY				
	FLOW UNITS	kg/hr			
	PRESSURE UNITS	kPa			
	TEMP. UNITS	°C			
	MANUFACTURER.	DIETERICH STANDARD			
	MODEL NO.	ANR-73- 2" Sch. 40- C25			
	SERVICE:	SECONDARY AIR TO ZONE 1 - FLOW	SECONDARY AIR TO ZONE 2 - FLOW	SECONDARY AIR TO ZONE 3 - FLOW	SECONDARY AIR TO ZONE 4 - FLOW

NOTES

① INSTRUMENT CONNECTIONS WITH VALVES TO SUIT THE PORTABLE METERS SPECIFIED IN NOTE ③

② TWO POINTS CALIBRATED: VENDOR TO SUPPLY ACCURATE ΔP FIGURE
- 500 kg/hr FLOW (14397 SCFH @ 14.69 psia 60°F)
  ΔP = 3.24 kPa (12.99 in. w.c.)
- 150 kg/hr FLOW (4319 SCFH @ 14.69 psia 60°F)
  ΔP = 0.291 kPa (1.17 in w.c.)

③ TWO PORTABLE METERS TO SERVICE FE-011, FE-012, FE-013, FE-014, FE-015 (SPEC. 8708) SHALL BE SUPPLIED TO COVER THE TWO RANGES IN NOTE ②
- EAGLE EYE EFP-F3 - kg/H 300 x NM
- EAGLE EYE EFP-F3 - kg/H 150 x NM

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FLOW ELEMENTS
INSTRUMENT SPECIFICATION

A | 0243 | | 8707 | 0

ABANDONED ALTERNATIVE TO ROTAMETERS ON 8739-8740

	TAG NUMBER	FE-015			
PIPING	SIZE & SCHEDULE				
	UPSTREAM - DIAMETERS				
	DOWNSTREAM - DIAMETERS				
	INSIDE DIAMETER				
EQUIPT.	ELEMENT ONLY				
	ELEMENT & HOLDER				
	COMPLETE METERING RUN				
ELEMENT	TYPE: ORIFICE OR OTHER				
	MOUNTING METHOD				
	MATERIAL				
	THICKNESS				
	BORE				
	d/D (β) RATIO				
HOLDER	MATERIAL				
	RATING				
	LINE MOUNTING METHOD				
	TAP STYLE				
	TAP FITTINGS: SIZE & TYPE				
ACCESSORIES	STRAIGHTENING VANES				
	GASKETS, STUDS & NUTS				
PROCESS	FLUID				
	MAXIMUM △ P (SIZING)				
	FLOW @ △ P SIZING				
FLUID	FLOW: DESIGN MAX.				
	PRESSURE: DESIGN MAX.				
	TEMPERATURE: DESIGN MAX.				
	VISCOSITY @ NORMAL FLOW				
	RELATIVE DENSITY @ NORMAL FLOW				
	STEAM QUALITY				
	FLOW UNITS				
	PRESSURE UNITS				
	TEMP. UNITS				
	MANUFACTURER.				
	MODEL NO.				
	SERVICE	SECONDARY AIR TO ZONE 5 -FLOW			
NOTES					

SPECIFICATION IDENTICAL TO FE-01 (SEE 0243-8707)

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FLOW ELEMENTS
INSTRUMENT SPECIFICATION

A 0243 8708

	INSTRUMENT TAG NUMBER	FT-004	FT-010		FT-017
TRANSMITTER	TYPE: ΔP OR OTHER	ΔP	ΔP		ΔP
BODY	RATING: kPa				
BODY	MATERIAL	①	①		①
BODY	CONNECTIONS: SIZE & TYPE	1/2" NPT	1/2" NPT		1/2" NPT
TRANSMITTER	CAPSULE MATERIAL	316SS	316SS		316SS
TRANSMITTER	DIFFERENTIAL RANGE: kPa	0 - 3.00	0 - 4.50		0 - 6.00
TRANSMITTER	SUPPLY REQUIREMENTS	2 WIRE	2 WIRE		2 WIRE
TRANSMITTER	SUPPLY METER OR GAUGE	—	—		—
TRANSMITTER	OUTPUT	4-20 mA	4-20mA		4-20mA
TRANSMITTER	OUTPUT METER OR GAUGE	—	—		—
TRANSMITTER	PROCESS FLOW INDICATION	—	—		—
TRANSMITTER	ENCLOSURE; CEMA TYPE	④	④		④
TRANSMITTER	ELEC. CONN.: SIZE | THD. OR b/e	1/2"	1/2"		1/2"
ACCESSORIES	MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE		FOR 50mm PIPE
ACCESSORIES	MANIFOLD 3 or 5 VALVE	3 VLV. ②	3 VLV. ②		3 VLV. ②
ACCESSORIES	MANIFOLD MATERIAL	316 SS	316 SS		316 SS
ACCESSORIES	SQUARE ROOT EXTRACTOR	—	—		—
ACCESSORIES	FILTER REGULATOR	—	—		—
ELEMENT	TAG NUMBER	FE-004	FE-010		FE-017
ELEMENT	TYPE: ORIFICE OR OTHER	ORIFICE	ORIFICE		ORIFICE
ELEMENT	REFER TO INTEG SPEC.	0243-8705	0243-8706		0243-8706
PROCESS	FLUID	AIR	AIR		AIR
FLUID	FLOW NORM. MAX.	958 | 1600	504 | 1000		50 | 80
FLUID	PRESS.: NORM. MAX.	69.0 | 83	36.9 | 83		68.3 | 83
FLUID	TEMPERATURE: C NORM. MAX.	66	66		66
FLUID	REL. DENSITY @ NORMAL FLOW	1.00 AIR	1.00 AIR		1.00 AIR
FLUID	STEAM QUALITY				
PROCESS	FLOW UNITS	kg/hr	kg/hr		kg/hr
PROCESS	PRESS UNITS	kPa	kPa		kPa
PROCESS	TEMP. UNITS	°C	°C		°C
	SERVICE	PRIMARY AND SECONDARY AIR - FLOW	SECONDARY AIR - FLOW		LOOP SEAL AIR - FLOW
	MANUFACTURER ③	ROSEMOUNT	ROSEMOUNT		ROSEMOUNT
	MODEL NO. ③	1151 DP-3-E-12 B1, E6	1151 DP-3-E-12 B1, E6		1151 DP-3-E-12 B1, E6

NOTES.

① CADMIUM PLATED CARBON STEEL
② ANDERSON GREENWOOD M4AVS OR EQUAL
③ OR EQUAL
④ CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP E, F, G

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FLOW TRANSMITTER
INSTRUMENT SPECIFICATION

A	0243		8709	0

	INSTRUMENT TAG NUMBER	FT-018			FT-089		FT-096	
TRANSMITTER	TYPE: ΔP OR OTHER	ΔP			VORTEX		VORTEX	
BODY	RATING: kPa							
BODY	MATERIAL	①			316 SS		316SS	
BODY	CONNECTIONS: SIZE & TYPE	1/2"NPT			INLINE - BETWEEN		INLINE-BETWEEN	
BODY					ANSI 150# FLANGES		ANSI 150# FLANGES	
BODY				METER SIZE →	25mm (1")		25mm (1")	
	CAPSULE MATERIAL	316SS						
	DIFFERENTIAL RANGE: kPa	0- 4.50		FLOW RANGE ④ →	0 -180 L/min		0- 80 L/min	
	SUPPLY REQUIREMENTS	2 WIRE			2 WIRE		2WIRE	
	SUPPLY METER OR GAUGE	—			–		–	
	OUTPUT	4-20 mA			4-20mA		4-20mA	
	OUTPUT METER OR GAUGE	—			–		–	
	PROCESS FLOW INDICATION	—			–		–	
	ENCLOSURE; CEMA TYPE	⑤						
	ELEC. CONN.: SIZE | THD. OR k/o	½"			½"		½"	
				LINE BOLTING	STEEL		STEEL	
				+ GASKETS	INCLUDED		INCLUDED	
ACCESSORIES	MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE						
	MANIFOLD 3 or 5 VALVE	3 VLV. ②						
	MANIFOLD MATERIAL	316SS						
	SQUARE ROOT EXTRACTOR	—						
	FILTER REGULATOR	—						
ELEMENT	TAG NUMBER	FE-018						
	TYPE: ORIFICE OR OTHER	ORIFICE						
	REFER TO INTEG SPEC.	0243-8706						
PROCESS	FLUID	AIR			WATER		WATER	
FLUID	FLOW NORM. MAX.	133	160		99.1	168	47.3	54.4
FLUID	PRESS.: NORM. MAX.	68.3	83			470		410
FLUID	TEMPERATURE: C NORM. MAX.	66			29		29	
FLUID	REL. DENSITY @ NORMAL FLOW	1.00 AIR			0.996		0.996	
FLUID	STEAM QUALITY							
	FLOW UNITS	kg/hr			L/min		L/min	
	PRESS UNITS	kPa			kPa		kPa	
	TEMP. UNITS	°C			°C		°C	
	SERVICE	FLY ASH RECYCLE AIR - FLOW			PLANT COOL WATER TO FLUE GAS COOLER - FLOW		PLANT COOL. WATER TO BAYONET TUBE NO. 1 - FLOW	
	MANUFACTURER ③	ROSEMOUNT			FISHER		FISHER	
	MODEL NO. ③	1151DP-3-E-12 B1,E6			DV2001		DV2001	

NOTES.

① CADMIUM PLATED CARBON STEEL
② ANDERSON GREENWOOD M4AVS OR EQUAL
③ OR EQUAL
④ MINIMUM FLOW CAPABILITY OF METER TO BE ADVISED BY VENDOR: ______
⑤ CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C,D, CLASS II GROUP E,F,G

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FLOW TRANSMITTER
INSTRUMENT SPECIFICATION

A	0243		8710	0

	INSTRUMENT TAG NUMBER	FT-098	FT-100	FT-102	
TRANSMITTER	TYPE: Δ P OR OTHER	VORTEX	VORTEX	VORTEX	
BODY	RATING: kPa				
BODY	MATERIAL	316 SS	316 SS	316 SS	
BODY	CONNECTIONS: SIZE & TYPE	INLINE - BETWEEN ANSI 150# FLANGES	INLINE - BETWEEN ANSI 150# FLANGES	INLINE - BETWEEN ANSI 150# FLANGES	
BODY	METER SIZE	25 mm (1")	25 mm (1")	25 mm (1")	
	CAPSULE MATERIAL				
	FLOW RANGE: ②	0-80 L/min	0-80 L/min	0-80 L/min	
	SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	
	SUPPLY METER OR GAUGE	–	–	–	
	OUTPUT	4-20mA	4-20mA	4-20mA	
	OUTPUT METER OR GAUGE	–	–	–	
	PROCESS FLOW INDICATION	–	–	–	
	ENCLOSURE; CEMA TYPE				
	ELEC. CONN.: SIZE | THD. OR b/e	½"	½"	½"	
	LINE BOLTING + GASKETS	STEEL INCLUDED	STEEL INCLUDED	STEEL INCLUDED	
ACCESSORIES	MOUNTING BRACKET & HARDWARE				
ACCESSORIES	MANIFOLD 3 or 5 VALVE				
ACCESSORIES	MANIFOLD MATERIAL				
ACCESSORIES	SQUARE ROOT EXTRACTOR				
ACCESSORIES	FILTER REGULATOR				
ELEMENT	TAG NUMBER				
ELEMENT	TYPE: ORIFICE OR OTHER				
ELEMENT	REFER TO INTEG SPEC.				

PROCESS		FT-098 NORM.	FT-098 MAX.	FT-100 NORM.	FT-100 MAX.	FT-102 NORM.	FT-102 MAX.
FLUID	FLUID	WATER		WATER		WATER	
FLUID	FLOW NORM. MAX.	47.3	54.4	47.3	54.4	47.3	54.4
FLUID	PRESS.: NORM. MAX.		410		410		410
FLUID	TEMPERATURE: C NORM. MAX.	29		29		29	
FLUID	REL. DENSITY @ NORMAL FLOW	0.996		0.996		0.996	
FLUID	STEAM QUALITY						
PROCESS	FLOW UNITS	L/min		L/min		L/min	
PROCESS	PRESS UNITS	kPa		kPa		kPa	
PROCESS	TEMP. UNITS	°C		°C		°C	

	FT-098	FT-100	FT-102	
SERVICE	PLANT COOL. WATER TO BAYONET TUBE NO.2 - FLOW	PLANT COOL. WATER TO BAYONET TUBE NO.3 - FLOW	PLANT COOL. WATER TO BAYONET TUBE NO.4 - FLOW	
MANUFACTURER ①	FISHER	FISHER	FISHER	
MODEL NO. ①	DV 2001	DV 2001	DV 2001	

NOTES

① OR EQUAL
② MINIMUM FLOW CAPABILITY OF METER TO BE ADVISED BY VENDOR: ________

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C91

FLOW TRANSMITTER
INSTRUMENT SPECIFICATION

A	0243		8711	0

GENERAL	1	Tag Number			FI-092	FI-106
	2	Service			PLANT COOL. WTR. TO BED DRAIN COOLER - FLOW	PLANT COOL. WTR. TO TRANS. CONV. NO.2 - FLOW
	3	Line No./Vessel No.				
	4	Function			INDICATE	INDICATE
	5	Mounting			PIPE (INLINE)	PIPE (INLINE)
	6	Power Supply			—	—
	7	Conn. Size / Type			20mm (3/4") / NPT	20mm (3/4") / NPT
	8	Inlet Dir. / Outlet Dir.			LEFT / RIGHT	LEFT / RIGHT
	9	Fitting Material			316SS	316SS
	10	Packing or O-Ring Mtl.			STD.	STD
	11	Enclosure Type			SIDE PLATE	SIDE PLATE
METER	12	Size / Float Guide			9 / FLUTES	9 / FLUTES
	13	Tube Mtl. / Float Mtl.			GLASS / 316 SS	GLASS / 316SS
	14	Meter Scale: Length & Type			250 mm	250mm
	15	Meter Scale Range			0-25 L/min	0-25 L/min
	16	Meter Factor			—	—
	17	Rated Accuracy			2 %	2 %
	18	Hydraulic Calib. Required			—	—
FLUID DATA	19	Fluid			WATER	WATER
	20	Color or Transparency			CLEAR	CLEAR
	21	Maximum Flow Rate			20.5 L/min	22.7 L/min
	22	Norm Flow / Min Flow			13.7 L/min / 2.5 L/min	0 /
	23	Oper. Specific Gravity (Liq)			0.996	0.996
	24	Max Oper. Viscosity				
	25	Oper. Press. / Oper. Temp.			500 kPa / 29 °C	500 kPa / 29 °C
	26	Oper. Density (Gases)			—	—
	27	Std. Density / Mol. Wgt.			— / —	— / —
	28	Max. Allowable Press. Drop				
	29					
EXT	30	Extension Well Mtl.				
	31	Gasket Mtl.				
XMTR	32	Transmitter Output				
	33	Trans. Enclosure Class				
	34	Scale Range				
ALARM	35	No. of Contacts / Form				
	36	Rating / Housing				
	37	Action				
	38					
OPTIONS	39	Valve Size & Material			BY OTHERS	BY OTHERS
	40	Valve Location				
	41	Const. Diff. Relay Mtl.				
	42	Purge Meter Tubing				
	43	Airset				
	43a					
	44	Manufacturer			BROOKS ③	BROOKS ③
	45	Model Number			1110	1110
	46	Tube Number			R-9M-25-1	R-9M-25-1
	47	Float Number			9-LJ-160	9-LJ-160

Notes: ③ OR EQUAL

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ROTAMETERS 3092
INSTRUMENT SPECIFICATION

A	0243		8712	0

	TAG NUMBER	PT-002	PT-008	PT-005	PT-043
TRANSMITTER	TYPE: Δ P OR OTHER	GAUGE PRESS.	GAUGE PRESS.	GAUGE PRESS.	GAUGE PRESS.
BODY	PRESS. RATING & UNITS:				
BODY	MATERIAL	③	③.	③	③
BODY	CONNECTIONS: SIZE & TYPE	1/2"NPT	1/2" NPT	1/2" NPT	1/2" NPT
TRANSMITTER	CAPSULE MATERIAL	316 SS	316SS	316SS	316SS
TRANSMITTER	PRESSURE RANGE , UNITS	0-100 kPa	0-50 kPa.	0-80 kPa	0-50 kPa
TRANSMITTER	SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	2 WIRE
TRANSMITTER	SUPPLY METER OR GAUGE	—	—	—	—
TRANSMITTER	OUTPUT	4-20mA	4-20mA	4-20mA	4-20mA
TRANSMITTER	OUTPUT METER OR GAUGE	—	—	—	—
TRANSMITTER	PROCESS PRESSURE INDICATION	—	—	—	—
TRANSMITTER	STATIC HEAD COMPENSATION & UNITS	—	—	—	—
TRANSMITTER	ENCLOSURE: CEMA TYPE	⑤	⑤	⑤	⑤
TRANSMITTER	ELEC. CONN.: SIZE | THD. OR K/O	1/2"	1/2"	1/2"	1/2"
ACCESSORIES	MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE
ACCESSORIES	INSTRUMENT VALVE				
PROCESS	FLUID	AIR	AIR	AIR	②
FLUID	PRESSURE (DIFF'L) NORM. MAX.	— —	— —	— —	— —
FLUID	PRESSURE (STATIC) NORM. MAX.	69.0 83	26.2 44.6 ①	37 67 ①	26 45 ①
FLUID	TEMPERATURE: NORM. MAX.	66	66	66	②
FLUID	REL. DENSITY @ NORMAL FLOW	1.00 (AIR)	1.00 (AIR)	1.00 (AIR)	
FLUID	STEAM QUALITY				
PROCESS	FLOW UNITS				
PROCESS	PRESS. UNITS	kPa	kPa	kPa	kPa
PROCESS	TEMP. UNITS	°C	°C	°C	°C
	MANUFACTURER: ④	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT
	MODEL NO: ④	1151GP-5E-12 B1, E6	1151GP-5E-12 B1, E6	1151GP-5E-12 B1, E6	1151GP-5E-12 B1, E6
	SERVICE:	COMBUSTION AIR HEADER - PRESS.	PRIMARY AIR WINDBOX - PRESS.	SEC. AIR BEFORE FLOW ELEMENT-PRESS	FLUIDIZED BED - PRESS.

NOTES.

① MAXIMUM DESIGN PRESSURE 83 kPa

② FLUIDIZED BED (IN COMBUSTOR) AT 1100°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE. CONSTANT AIR PURGE WILL BE SUPPLIED TO TAPPING POINT.

③ CADMIUM PLATED CARBON STEEL.

④ OR EQUAL

⑤ CSA EXPLOSION PROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP EFG

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PRESSURE TRANSMITTER

1093

INSTRUMENT SPECIFICATION

A	0243		8713	0

	TAG NUMBER	PT-052	PT-062	PDT-064	PDT-065
TRANSMITTER	TYPE: Δ P OR OTHER	GAUGE PRESS.	GAUGE PRESS.	ΔP	ΔP
BODY	PRESS. RATING & UNITS:				
	MATERIAL	④	④.	④	④
	CONNECTIONS: SIZE & TYPE	½" NPT	½" NPT	½" NPT	½" NPT
	CAPSULE MATERIAL	316 SS	316 SS	316SS·	316SS
	PRESSURE RANGE , UNITS	-10~40 kPa	-6~0 kPa.	0-8 kPa	0-25 kPa
	SUPPLY REQUIREMENTS	2WIRE	2 WIRE	2WIRE	2 WIRE
	SUPPLY METER OR GAUGE	—	—	—	—
	OUTPUT	4-20mA	4-20mA	4-20mA	4-20mA
	OUTPUT METER OR GAUGE	—	—	—	—
	PROCESS PRESSURE INDICATION	—	—	—	—
	STATIC HEAD COMPENSATION & UNITS	—	—	—	—
	ENCLOSURE: CEMA TYPE	⑤	⑤	⑤	⑤
	ELEC. CONN.: SIZE THD. OR K/O	½"	½"	½"	½"
	ZERO ELEVATION	-10 kPa = 0%	-6 kPa = 0%		
ACCESSORIES	MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE
	INSTRUMENT VALVE				
	3VALVE MANIFOLD			YES ⑥	YES ⑥
	MANIFOLD MAT'L			316 SS ⑥	316SS ⑥
PROCESS	FLUID	②	③	②	②
FLUID	PRESSURE (DIFF'L) NORM. / MAX.	— / —	— / —	3.7 / 5.5	10.0 / 19.9
	PRESSURE (STATIC) NORM. / MAX.	0.0 / ①	-2.0 / -6.2	/ 69	/ 69
	TEMPERATURE: NORM. / MAX.	②	③	②	②
	REL. DENSITY @ NORMAL FLOW				
	STEAM QUALITY				
	FLOW UNITS				
	PRESS. UNITS	kPa	kPa	kPa	kPa
	TEMP. UNITS	°C	°C	°C	°C
	MANUFACTURER:	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT
	MODEL NO:	1151GP-5E-12 B1, E6	1151-GP-3E-12 B1, E6	1151DP-4E-12 B1, E6	1151DP-4E-12 B1, E6
	SERVICE	COMBUSTOR - PRESS.	CYCLONE GAS OUTLET - PRESS.	PRI. AIR DISTRIBUTᴺ NOZZLES-DIFF'L PRESS	COMBUSTOR DIFF'L PRESS

NOTES.

① MAXIMUM DESIGN PRESSURE 83 kPa

② FLUIDIZED BED (IN COMBUSTOR) AT 1100°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE. CONSTANT AIR PURGE WILL BE SUPPLIED TO TAPPING POINT.

③ DIRTY FLUEGASES AT 1100°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE.

④ CADMIUM PLATED CARBON STEEL

⑤ CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP E, F, G

⑥ ANDERSON GREENWOOD M4AVS (ADDED AFTER ISSUE OF INQUIRY)

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PRESSURE TRANSMITTER

INSTRUMENT SPECIFICATION

A	0243		8714	0

	TAG NUMBER	PT-066	PDT-070	PDT-118⑥	
TRANSMITTER	TYPE: Δ P OR OTHER	GAUGE PRESS.	ΔP	ΔP	
TRANSMITTER	BODY: PRESS. RATING & UNITS:				
TRANSMITTER	BODY: MATERIAL	③	③	③	
TRANSMITTER	BODY: CONNECTIONS: SIZE & TYPE	1/2" NPT	1/2" NPT	1/2" NPT	
TRANSMITTER	CAPSULE MATERIAL	316 SS	316 SS	316 SS	
TRANSMITTER	PRESSURE RANGE, UNITS	-6~0 kPa	0-2 kPa	0-25 kPa	
TRANSMITTER	SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	
TRANSMITTER	SUPPLY METER OR GAUGE	—	—	—	
TRANSMITTER	OUTPUT	4-20mA	4-20mA	4-20mA	
TRANSMITTER	OUTPUT METER OR GAUGE	—	—	—	
TRANSMITTER	PROCESS PRESSURE INDICATION	—	—	—	
TRANSMITTER	STATIC HEAD COMPENSATION & UNITS	—	—	—	
TRANSMITTER	ENCLOSURE: CEMA TYPE	④	④	④	
TRANSMITTER	ELEC. CONN.: SIZE | THD. OR E/O	1/2"	1/2"	1/2"	
TRANSMITTER	ZERO ELEVATION	-6 kPa = 0%			
ACCESSORIES	MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	
ACCESSORIES	INSTRUMENT VALVE				
ACCESSORIES	3 VALVE MANIFOLD		YES ⑤	YES ⑤	
ACCESSORIES	MANIFOLD MAT'L		316SS ⑤	316SS ⑤	
PROCESS	FLUID	①	①	②	
PROCESS	FLUID: PRESSURE (DIFF'L) NORM.	—	1.0	12.5	
PROCESS	FLUID: PRESSURE (DIFF'L) MAX.	—	1.5	20	
PROCESS	FLUID: PRESSURE (STATIC) NORM.	-3.0		-1.0	
PROCESS	FLUID: PRESSURE (STATIC) MAX.	-6.2	-6.2		
PROCESS	FLUID: TEMPERATURE: NORM.	①	①	②	
PROCESS	FLUID: TEMPERATURE: MAX.				
PROCESS	FLUID: REL. DENSITY @ NORMAL FLOW				
PROCESS	FLUID: STEAM QUALITY				
PROCESS	FLOW UNITS				
PROCESS	PRESS. UNITS	kPa	kPa	kPa	
PROCESS	TEMP. UNITS	°C	°C	°C	
	MANUFACTURER:	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	
	MODEL NO:	1151GP-3E-12 B1, E6	1151DP-3E-12 B1, E6	1151DP-4E-12 B1, E6	
	SERVICE	FLUE GAS COOLER GAS OUT. - PRESS.	BAGHOUSE. DIFF'L PRESS.	CYCLONE OUT. TO RECYCLE - DIFF'L PRESS.	

NOTES.

① DIRTY FLUE GASES AT MAX. 260°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE
② FLUIDIZED BED MATERIAL AT 1100°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE. CONSTANT AIR PURGE WILL BE SUPPLIED TO TAPPING POINTS
③ CADMIUM PLATED CARBON STEEL
④ CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C,D, CLASS II GROUP E,F,G
⑤ ANDERSON GREENWOOD M4AVS (ADDED AFTER ISSUE OF INQUIRY)
⑥ PDT-118 CHANGES AFTER ISSUE OF INQUIRY: RANGE, MODEL NO.

ENERGY, MINES & RESOURCES
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PRESSURE TRANSMITTER
INSTRUMENT SPECIFICATION

A	0243		8715	0

		TAG NUMBER	TT-003	TT-053	TT-063	TT-067
TRANSMITTER		RANGE: °C	0-100	200-1200	400-1000	100-300
		SENSING ELEMENT	TYPE K TH. CPL.	TYPE K TH. CPL.	TYPE K TH. CPL	TYPE K TH. CPL
		SINGLE OR MULTIPLE ELEMENT	SINGLE	SINGLE	SINGLE	SINGLE
		SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	2 WIRE
		SUPPLY METER OR GAUGE	–	–	–	–
		OUTPUT	4-20mA	4-20mA	4-20mA	4-20mA
		OUTPUT METER OR GAUGE	–	–	–	–
		PROCESS TEMPERATURE INDICATOR	–	–	–	–
		OVER-RANGE PROTECTION	–	–	–	–
		ZERO SUPPRESSION	–	–	–	–
		ENCLOSURE: CEMA TYPE	②	②	②	②
		ELEC. CONN.: SIZE | THD. OR E/O	1/2"	1/2"	1/2"	1/2"
		MEASURING JUNCTION	GROUNDED	GROUNDED	GROUNDED	GROUNDED
SENSING ELEMENT		T/W: REFER TO SPEC.:	0243-8718	BY OTHERS	0243-8718	0243-8718
		ELEMENT: REFER TO SPEC.	0243-8718	BY OTHERS	0243-8718	0243-8718
	FILLED SYSTEM	CLASS				
	BULB	MATERIAL				
		STRAIGHT OR COILED				
		BENDABLE EXTENSION				
		PLAIN OR UNION				
		INSERTION LENGTH				
		DIST. ABOVE/ BELOW INSTR.				
	CAPIL-LARY	MATERIAL				
		LENGTH				
	ARMOR	MATERIAL				
		COVER MTL. (IF ANY)				
ACCESS.		MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE
		FILTER REGULATOR				
PROCESS		FLUID	AIR	FLUIDIZED BED	DIRTY FLUE GAS	DIRTY FLUE GAS
	FLUID	FLOW: RATE & UNITS				
		PRESS.: UNITS				
		TEMPERATURE: UNITS	66 °C	1100 °C	860°C	150°C
		MANUFACTURER ①	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT
		MODEL NO. ①	444-TK1-D1-A2, EB	444-TK3-D1-A2, EB	444-TK2-D1-A2, EB	444-TK1-D1-A2, EB
		SERVICE:	COMBUSTION AIR HEADER - TEMP	COMBUSTOR OUTLET TO CYCLONE - TEMP	CYCLONE GAS OUTLET - TEMP.	FLUE GAS COOLER GAS OUT. - TEMP

NOTES.

① OR EQUAL
② CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP E, F, G

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TEMPERATURE TRANSMITTER
INSTRUMENT SPECIFICATION

A	0243		8716	0

			TAG NUMBER	TT-088	TT-091	TT-104	
TRANSMITTER			RANGE: °C	0 - 100	0 - 100	0 - 100	
			SENSING ELEMENT	TYPE K TH. CPL.	TYPE K TH. CPL	TYPE K TH CPL.	
			SINGLE OR MULTIPLE ELEMENT	SINGLE	SINGLE	SINGLE	
			SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	
			SUPPLY METER OR GAUGE	–	–	–	
			OUTPUT	4-20mA	4-20mA	4-20mA	
			OUTPUT METER OR GAUGE	–	–	–	
			PROCESS TEMPERATURE INDICATOR	–	–	–	
			OVER-RANGE PROTECTION	–	–	–	
			ZERO SUPPRESSION	–	–	–	
			ENCLOSURE: CEMA TYPE	②	②	②	
			ELEC. CONN.: SIZE | THD. OR E/O	1/2"	1/2"	1/2"	
			MEASURING JUNCTION	GROUNDED	GROUNDED	GROUNDED	
SENSING ELEMENT			T/W: REFER TO SPEC.:	0243-8718	0243-8718	0243-8718	
			ELEMENT: REFER TO SPEC.	0243-8718	0243-8718	0243-8718	
	FILLED SYSTEM		CLASS				
		BULB	MATERIAL				
			STRAIGHT OR COILED				
			BENDABLE EXTENSION				
			PLAIN OR UNION				
			INSERTION LENGTH				
			DIST. ABOVE/ BELOW INSTR.				
		CAPIL-LARY	MATERIAL				
			LENGTH				
		ARMOR	MATERIAL				
			COVER MTL. (IF ANY)				
ACCESS.			MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	
			FILTER REGULATOR				
PROCESS			FLUID	WATER	WATER	WATER	
	FLUID		FLOW: RATE & UNITS				
			PRESS.: UNITS				
			TEMPERATURE: UNITS	29°C	66°C	66°C	
			MANUFACTURER ①	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	
			MODEL NO. ①	444-TK1-D1-A2, EB	444-TK1-D1-A2, EB	444-TK1-D1-A2, EB	
			SERVICE	PLANT COOLING WTR. AT HEAT EXCHANGER OUTLET - TEMP.	PLANT COOLING WTR AT FLUE GAS COOLER OUTLET - TEMP.	PLANT COOLING WTR FROM BAYONET TUBES - TEMP.	

NOTES.

① OR EQUAL

② CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP E, F, G

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TEMPERATURE TRANSMITTER

INSTRUMENT SPECIFICATION

A	0243		8717	0

1. Complete Assembly ☒ Other ________
MFR. & Model No. ________

ELEMENT

MFR. & Model No. ________
2. ISA Type K (CHROMEL-ALUMEL) Wire Size ____
3. Sheathed: 6.35mm O.D. Material 316 SS
Exposed ☐ Grounded ☒ Ungrounded ☐
Enclosed ☒ Beaded Insulators ☐ Spring Loaded ☒
4. Nipple Size 15mm Dimension "N" 76.2 mm Union ☐
5. Packed Connector ________

HEAD

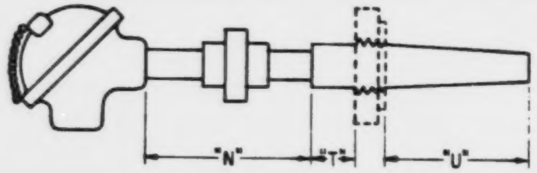
6. Screw-Cap & Chain ☒ Other ________

7. Material ALUMINUM Conduit Conn. 1/2" NPT
8. Terminal Block: Single ☒ Duplex ☐

WELL OR TUBE

9. Material 316 SS
10. Construction: Tapered ☒ Straight ☐
Drilled ☐ Built-Up ☐ Closed End Tube ☐
11. Dimensions: MFR. STD. ☒ O.D. ____ I.D. ____
12. Connections: Process 3/4" NPT INT. 1/2" NPT
13. Other Specs.: ________

Notes: 6.35 mm = 1/4" SHEATH O.D.
15mm = 1/2" NIPPLE
76.2mm = 3" NIPPLE



DIMENSION T = LAGGING EXTENSION ONLY (NOT INCLUDING WRENCH FLATS).

Rev.	Tag No.	Well Dimens. (mm)		Element Length	(mm) LINE SIZE	Type	Gage	Service	Notes
		"U"	"T"						
	TEW-003	80	25	①	150	K		AIR @ 66°C	
	TEW-053	400	0		940			FLUIDIZED BED @ 1100°C	
	TEW-063	500	100		–			DIRTY FLUE GAS @ 860°C	②
	TEW-067	100	50		200			DIRTY FLUE GAS @ 150°C	
	TEW-088	150	0		50			WATER @ 29°C	
	TEW-091	150	0		30			WATER @ 66°C	
	TEW-104	150	0		40			WATER @ 66°C	
	TEW-072	100	50		200			CLEAN FLUE GAS @ 150°C	
	TEW-074	150	0		25			WATER @ 16°C	
	TEW-079	150	0		50			@ 29°C	
	TEW-080	150	0		50			@ 70°C	
	TEW-087	150	0		50			@ 66°C	
	TEW-090	150	0		30			@ 29°C	
	TEW-093	150	0		15			@ 29°C	
	TEW-094	150	0		15			@ 66°C	
	TEW-095	150	0		40			@ 29°C	
	TEW-097	150	0		25			@ 66°C	
	TEW-099	150	0		25			@ 66°C	
	TEW-101	150	0		25			@ 66°C	
	TEW-103	150	0		25			@ 66°C	
	TEW-107	150	0		15			@ 29°C	
	TEW-108	150	0	①	15	K		WATER @ 66°C	

Notes:
① AS REQUIRED TO SUIT COMPLETE ASSEMBLY.
② U DIM. / LINE SIZE CHANGED FOLLOWING ISSUE OF INQUIRY.

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THERMOCOUPLE ASSEMBLIES
INSTRUMENT SPECIFICATION

A	0243		8718	0

		TAG NUMBER	TIC-083			
CONTROLLER		RANGE: C	0-50 °C			
		SENSING ELEMENT OR INPUT	FILLED SYSTEM			
		SUPPLY REQUIREMENTS AIR	140 kPa			
		SUPPLY METER OR GAUGE	0-200 kPa			
		OUTPUT	20-100 kPa			
		OUTPUT METER OR GAUGE	0-200 kPa			
		ON TEMP. INCREASE, OUTPUT	DECREASES			
		PROCESS TEMP. INDICATOR °C	0-50 °C			
		OVER-RANGE PROTECTION				
		ZERO SUPPRESSION				
	FUNCTIONS	P.B. OR GAIN YES:	TBA			
		RESET YES:	TBA			
		RATE YES:	TBA			
		ENCLOSURE: CEMA TYPE	WEATHERPROOF			
		ELEC. CONN.: SIZE | THD. OR K/O				
		BURN OUT PROTECTION DIRECTION				
		BUMPLESS AUTO-MAN. TRANSFER	INCL.			
SENSING ELEMENT		INSTRUMENT TAG NUMBER				
		ELEMENT: ~~INTEG SPEC.~~	FILLED SYSTEM			
		T/W : ~~INTEG SPEC.~~	②			
	FILLED SYSTEM	CLASS	IA ③			
	BULB	MATERIAL	316 SS			
		STRAIGHT OR COILED	STRAIGHT			
		BENDABLE EXTENSION	MANUF. STANDARD			
		PLAIN OR UNION	ADJUSTABLE UNION			
		INSERTION LENGTH	SEE ②			
		DIST. ABOVE/ BELOW INSTR.				
	CAPILLARY	MATERIAL	316SS			
		LENGTH	4.5 mm			
	ARMOR	MATERIAL	FLEX. STAINLESS			
		COVER (IF ANY)				
ACCESS.		MOUNTING BRACKET & HARDWARE	FOR 50 mm PIPE			
		FILTER REGULATOR	MOUNTED ON			
			CONTROLLER			
			SET @ 140 kPa			
PROCESS		FLUID	WATER			
	FLUID	FLOW: RATE & UNITS	430 L/min			
		PRESS.: & UNITS	10 kPa			
		TEMPERATURE: & UNITS	29 °C			
		LINE SIZE	50 mm			
		SERVICE	PLANT COOL. WATER			
			HEADER - TEMP			
		MANUFACTURER: ①	FOXBORO			
		MODEL NO. ①	43AP-FA5C/ TA-1A-D-FS-SS-4542J18			

NOTES

① OR EQUAL

② THERMO-WELL: 316SS, U=150mm (LENGTH BELOW PROCESS THREADS), PROCESS CONNECTION 3/4" NPT

③ LIQUID EXPANSION TYPE - INSTRUMENT CASE AND CONNECTING TUBING COMPENSATION.

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TEMPERATURE CONTROLLER

INSTRUMENT SPECIFICATION

A 0243 8719 0

099

		TAG NUMBER		LC-075			
		STYLE: DISPLACEMENT OR OTHER		DISPLACEMENT (1)			
		RANGE		356mm 14"			
BODY		RATING: kPa		STD.			
		MATERIAL		CAST IRON CAGE			
	CONNECTIONS	LOCATION: UPPER		TOP (VERT.)			
		LOCATION: LOWER		BOTTOM (VERT.)			
		SIZE & TYPE		1 1/2" NPT			
		RATING					
		CENTRE-CENTRE DIMENSION		TBA			
		ROTATABLE HEAD		YES (RIGHT			
				HAND MOUNT)			
DISPLACER		LENGTH		356 mm			
	MTL.	FLOAT OR DISPLACER		304SS			
		EXTENSION ROD		STD.			
		TORQUE TUBE		STD.			
		AIR FIN TORQUE EXTENSION					
SENSING		TYPE: PNEUMATIC OR OTHER					
	ADJ.	RAISE/ LOWER LEVEL					
		FLUID DENSITY					
		SUPPLY REQUIREMENTS					
		OUTPUT					
		AS LEVEL RISES, OUTPUT					
CONTROLLER		TYPE: PNEUMATIC OR OTHER		PNEUMATIC			
	ADJUSTMENTS	OPERATING RANGE		0-356mm OF DISPLACER			
		PROPORTIONAL BAND	YES	TBA			
		RESET	YES	TBA			
		RATE					
		ANTI-RESET WIND-UP		YES			
		SUPPLY REQUIREMENTS	AIR	140 kPa			
		OUTPUT		20-100 kPa			
		AS LEVEL RISES, OUTPUT		DECREASES			
ACCESS.		FILTER-REGULATOR		INCL. (140 kPa)			
		GAUGE GLASS OR CONNECTIONS ONLY		—			
		TUBING MATERIAL		—			
		HIGH TEMPERATURE RELAY		—			
PROCESS		FLUID	UPPER LOWER	AIR WATER			
	FLUID	REL. DENSITY	UPPER LOWER	 0.996			
		TEMP.:	MAX. NORMAL	70°C 16-30°C			
		PRESSURE:	MAX. NORMAL	 ATM.			
		PRESSURE UNITS		kPa			
		TEMP. UNITS		°C			
		SERVICE		COOL. TOWER REMOTE			
				SUMP - LEVEL			
		MANUFACTURER	(2)	FISHER			
		MODEL NO.	(2)	2502F-249			

NOTES.

(1) FLOAT CAGE TYPE
(2) OR EQUAL

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LEVEL CONTROLLER

1100

INSTRUMENT SPECIFICATION

A	0243		8720	0

		TAG NUMBER	LG-077			
		SERVICE				
GAUGE		GAUGE & VALVES ASSY. OR GAUGE ONLY	GAUGE + VALVES			
GAUGE		TYPE: REFLEX OR OTHER	TUBULAR GLASS			
GAUGE		STYLE: WELD PAD OR OTHER	—			
GAUGE		TOTAL LEVEL:				
GAUGE	ASS'Y	QUANTITY				
GAUGE	ASS'Y	VISIBLE GLASS EACH	NOTE ①			
GAUGE	CONNECTIONS	LOCATION: SIDE OR OTHER				
GAUGE	CONNECTIONS	PIPE SIZE & TYPE				
GAUGE	MTL.	GLASS	BOROSILICATE GLASS			
GAUGE	MTL.	BODY				
GAUGE		PRESSURE RATING & UNITS:				
GAUGE		MANUFACTURER | CAT. Nº				
VALVES		QUANTITY	2			
VALVES		STRAIGHT OR OFFSET	OFFSET			
VALVES		CLOSURE: PLAIN OR QUICK	PLAIN			
VALVES		HANDLE: WHEEL OR OTHER	WHEEL			
VALVES	MTL.	BODY	CARBON STEEL			
VALVES	MTL.	TRIM	STAINLESS STEEL			
VALVES	CONN-ECTIONS	PROCESS: SIZE & TYPE	3/4" NPT			
VALVES	CONN-ECTIONS	GAUGE: SIZE & TYPE	3/4"			
VALVES	CONN-ECTIONS	UNION: PROCESS GAUGE				
VALVES		BONNET: UNION OR OTHER	STD.			
VALVES		RENEWABLE SEAT	NO			
VALVES		BALL CHECK	YES			
VALVES		EXPANSION COIL				
VALVES		PRESSURE RATING & UNITS:				
VALVES		MANUFACTURER | CAT. Nº				
ACCESSORIES		SHIELDS: MICA OR OTHER				
ACCESSORIES		ILLUMINATOR				
ACCESSORIES		CALIBRATED SCALE				
ACCESSORIES		GUARD RODS	YES: 4 INCL			
ACCESSORIES		PROTECTOR: GLASS OR OTHER				
ACCESSORIES		SUPPORT PLATE & BRACKETS				
PROCESS		FLUID: UPPER	AIR			
PROCESS		FLUID: LOWER	WATER			
PROCESS	FLUID	PRESS. RATING & UNITS:	ATMOSPHERIC			
PROCESS	FLUID	TEMPERATURE & UNITS:	16°C — 70°C			
PROCESS		SERVICE	COOL. TOWER REMOTE SUMP - LEVEL			
		MANUFACTURER ②	JERGUSON			
		MODEL NO. ②	NO. 136			

NOTES.

① VALVE ℄ ARE 42" (1067 mm) APART

② OR EQUAL

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LEVEL GAUGE (GLASS) 1101
INSTRUMENT SPECIFICATION

A	0243		8721	0

	TAG NUMBER			PC-086			
CONTROLLER		**RANGE:**		400-800 kPa			
		SENSING ELEMENT OR INPUT		SEE BELOW			
		SUPPLY REQUIREMENTS	AIR	140 kPa			
		SUPPLY METER OR GAUGE		0-200 kPa			
		OUTPUT		20-100 kPa			
		OUTPUT METER OR GAUGE		0-200 kPa			
		ON PRESS **INCREASE, OUTPUT**		INCREASES			
		PROCESS PRESS **INDICATOR**		400-800 kPa			
		OVER-RANGE PROTECTION		SEE BELOW			
		ZERO SUPPRESSION		400 kPa = 0%			
	FUNCTIONS	**P.B. OR GAIN**	YES	TBA:			
		RESET	YES	TBA:			
		RATE					
		ENCLOSURE: CEMA TYPE					
		ELEC. CONN.: SIZE	**THD. OR E/O**				
		ANTI-RESET WINDUP		YES			
		NORMAL SETPOINT		650 kPa			
		BUMPLESS AUTO-MANUAL		YES			
SENSING ELEMENT		SENSING ELEMENT TYPE		BOURDON TUBE			
		MATERIAL		316SS			
		CONNECTION SIZE/TYPE		1/2" NPT			
		OVER-PRESSURE AND UNDERPRESSURE PROTECTION		YES			
ACCESS.		**MOUNTING BRACKET & HARDWARE**		FOR 50mm PIPE			
		FILTER REGULATOR		INCL. SET 140 kPa			
PROCESS		**FLUID**		WATER			
	FLUID	**FLOW: RATE**	**& UNITS**				
		PRESS.:	**& UNITS**	621 kPa			
		TEMPERATURE:	**& UNITS**	29 °C			
		SERVICE:		PLANT COOL. WATER HEADER PRESS.			
		MANUFACTURER: ①		FISHER			
		MODEL NO: ①		4195 BFE			
NOTES		① OR EQUAL					

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	DRAWN	AF	1983 NOV. 1	
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	GENERAL										
1.	TYPE	PRESSURE		PRESSURE		PRESSURE		DIFFERENTIAL PRESSURE			
2.											
3.	TAG NO.	PSH-051		PSH-085		PSL-085		PDSH-120			
4.	SERVICE	COMBUSTOR - PRESSURE		PLANT COOL. WTR HEADER - PRESS.		PLANT COOL. WTR. HEADER - PRESS.		BAGHOUSE FLUE GAS-DIFF'L. PRESS			
5.	RANGE kPa	0-40 ③		0-1000 ④		0-1000 ④		0-4 ⑤			
	PRESSURE ELEMENT										
6.	TYPE	MANUF. STD		MANUF. STD.		MANUF. STD.		MANUF. STD.			
7.	MATERIAL			STAINLESS		STAINLESS					
8.	CONN: SIZE / LOCATION										
	THERMAL ELEMENT										
9.	TYPE SYSTEM										
10.	TYPE & SIZE CONN.										
11.	EXTENSION NECK										
12.	BULB MATERIAL										
13.	BULB LOCATION TO CASE										
14.	TUBING LENGTH										
15.	TUBING TYPE & MAT'L.										
16.	ARMOR MATERIAL										
17.	WELL CONN. SIZE & TYPE										
18.	WELL MATERIAL										
19.	"U" DIMENSION (NOMINAL)										
20.	"T" DIMENSION										
	SWITCH										
21.	TYPE	MICRO-SWITCH		MICRO-SWITCH		MICRO-SWITCH		MICRO-SWITCH			
22.	QUANTITY / FORM	1	SPDT	1	SPDT	1	SPDT	1	SPDT		
23.	ENCLOSURE	WEATHERPROOF		WEATHER PROOF		WEATHERPROOF		WEATHERPROOF			
24.	CONDUIT CONN. SIZE & TYPE	TBA:		TBA:		TBA.		TBA:			
25.	RATING: VOLTS / CY OR D.C.				D.C.		D.C.		D.C.		
26.	AMPS WATTS HP										
27.	LOAD TYPE			NON-IND		NON-IND		NON-IND.			
28.	MINIMUM DIFFERENTIAL	STD.		STD		STD.		STD.			
29.	DIFF: FIXED / ADJUST	✓		✓		✓		✓			
30.	ADJUSTMENT: INT / EXT	✓		✓		✓		✓			
31.	CONTACTS: OPEN CLOSE / ON PROC. / INCR. DECR.	OPEN	INCR	OPEN	INCR.	OPEN	DECR	OPEN	INCR		
	TERMINAL BLOCK	INCLUDED		INCL.		INCL.		INCL.			
	SERVICE CONDITIONS										
32.	TEMP: OPER. / MAX.	①		29°C		29°C		177°C	260°C		
33.	PRESS: OPER. / MAX.	0 kPa	69 kPa	621 kPa		621 kPa		②			
34.	TRIP POINT ⑥ kPa			650		500		1.5			
	FLUID	①		WATER		WATER		FLUE GAS			
35.	MANUFACTURER'S MODEL NO.										

① FLUIDIZED BED (IN COMBUSTOR) AT 1100°C. INSTRUMENT WILL BE MOUNTED IN A LOCATION AT AMBIENT TEMPERATURE, CONSTANT AIR PURGE WILL BE SUPPLIED TO TAPPING POINT.

② STATIC PRESS -3 TO -7 kPa, DIFF'L 1 TO 1.5 kPa.

③ OR NEAREST

④ OR NEAREST

⑤ OR NEAREST

⑥ TRIP POINT IS PRELIMINARY

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PRESSURE SWITCHES
INSTRUMENT SPECIFICATION

A	0243		8723	0

	GENERAL						
1.	TYPE	TEMPERATURE					
2.							
3.	TAG NO.	TSH-068					
4.	SERVICE	FLUE GAS COOLER OUTLET - TEMP					
5.	RANGE °C	0-350 ①					
	~~**PRESSURE ELEMENT**~~						
6.	~~TYPE~~						
7.	~~MATERIAL~~						
8.	~~CONN: SIZE | LOCATION~~						
	THERMAL ELEMENT						
9.	TYPE SYSTEM	LIQUID FILLED					
10.	TYPE & SIZE CONN.	ADJ. UNION					
11.	EXTENSION NECK						
12.	BULB MATERIAL	STAINLESS					
13.	BULB LOCATION TO CASE						
14.	TUBING LENGTH	4.5 m					
15.	TUBING TYPE & MAT'L.	STAINLESS CAPILLARY + ARMOUR					
16.	ARMOR MATERIAL	STAINLESS					
17.	WELL CONN. SIZE & TYPE	3/4 " NPT					
18.	WELL MATERIAL	316 SS					
19.	"U" DIMENSION (NOMINAL)	100mm					
20.	"T" DIMENSION	50mm					
	SWITCH						
21.	TYPE	MICRO-SWITCH					
22.	QUANTITY | FORM	1 | SPDT					
23.	ENCLOSURE	WEATHERPROOF					
24.	CONDUIT CONN. SIZE & TYPE	TBA.					
25.	RATING: VOLTS | CY OR D.C.	| D.C.					
26.	AMPS WATTS | HP						
27.	LOAD TYPE	NON - IND.					
28.	MINIMUM DIFFERENTIAL						
29.	DIFF: FIXED | ADJUST	✓					
30.	ADJUSTMENT: INT | EXT	✓					
31.	CONTACTS: OPEN CLOSE | ON PROC. | INCR. DECR.	OPEN | INCR.					
	SERVICE CONDITIONS						
32.	TEMP: OPER. | MAX.	177°C | 260°C					
33.	PRESS: OPER. | MAX.	-2 kPa | -7 kPa					
34.	TRIP POINT ② °C	250					
	FLUID	FLUE GAS					
35.	MANUFACTURER'S MODEL NO.						

① OR NEAREST
② TRIP POINT IS PRELIMINARY

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TEMPERATURE SWITCHES
INSTRUMENT SPECIFICATION

A	0243		8724	0

TAG NO.	PI-001			PI-019			PI-078			PI-081			PI-084		
TYPE: INDICATING | RECEIVER	✓			✓			✓			✓			✓		
MOUNTING: SURFACE | LOCAL | FLUSH		✓			✓			✓			✓			✓	
DIAL DIAMETER	115mm (4½")			115mm (4½")			115mm (4½")			115mm (4½")			115mm (4½")		
CASE MAT'L: PHENOL | ALUMINUM | OTHER	✓			✓			✓			✓			✓		
PRESS ELEMENT															
BOURDON | BELLOWS | OTHER	✓			✓			✓			✓			✓		
ELEMENT MAT'L															
BRONZE | STEEL | TYPE __ STNL. STL			316			316			316			316			316
RANGE kPa	0-160			0-100			0-400			0-1000			0-1000		
SOCKET MAT'L.															
BRONZE | STEEL | TYPE __ STNL. STL		✓			✓			✓			✓			✓	
CONNECTION															
NPT | OTHER	✓			✓			✓			✓			✓		
1/4" | 1/2" | OTHER		✓			✓			✓			✓			✓	
BACK | BOTTOM		✓			✓			✓			✓			✓	
MOVEMENT															
BRONZE | STNL. STL		✓			✓			✓			✓			✓	
NYLON | OTHER															
FLUID	AIR			AIR			WATER			WATER			WATER		
PRESS: OPER | MAX. kPa	83			50	83		180			621			621		
TEMP.: OPER. | MAX. °C		66			66		29			29	66		29	66	
ACCESSORIES															
- LIQUID FILLED GAUGE c/w THROTTLE SCREW	YES						YES			YES					
SERVICE	F.D. BLOWER DISCH. PRESS.			FLYASH RECYCLE AIR - PRESS.			COOLING TOWER PUMP DISCH PRESS.			PLANT COOL WTR. CIRC. PUMP. DISCH PRESS			PLANT COOL. WATER HEADER-PRESS.		
MANUFACTURER															
MANUFACTURER'S MODEL NO.															
NOTES.															

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PRESSURE GAUGES
INSTRUMENT SPECIFICATION

A	**0243**		8725	0

TAG NO.	PI-119						
TYPE: INDICATING | RECEIVER	✓						
MOUNTING: SURFACE | LOCAL | FLUSH		✓					
DIAL DIAMETER	115mm (4 1/2")						
CASE MAT'L: PHENOL | ALUMINUM | OTHER	✓						
PRESS ELEMENT							
BOURDON | BELLOWS | OTHER	✓						
ELEMENT MAT'L							
BRONZE | STEEL | TYPE __ STNL. STL			316				
RANGE kPa	0-100						
SOCKET MAT'L.							
BRONZE | STEEL | TYPE __ STNL. STL		✓					
CONNECTION							
NPT | OTHER	✓						
1/4" | 1/2" | OTHER		✓					
BACK | BOTTOM		✓					
MOVEMENT							
BRONZE | STNL. STL		✓					
NYLON | OTHER							
FLUID	AIR						
PRESS: OPER | MAX. kPa	30	83					
TEMP.: OPER. | MAX. °C		66					
ACCESSORIES							
SERVICE	SECONDARY AIR						
	HEADER - PRESS						
MANUFACTURER							
MANUFACTURER'S MODEL NO.							
NOTES.							

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PRESSURE GAUGES
INSTRUMENT SPECIFICATION

A | 0243 | | 8726 | 0

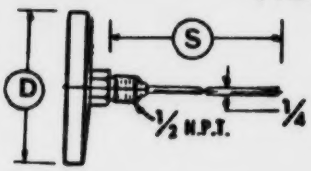

FIG. 1

FIG. 2

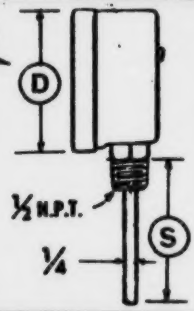

FIG. 3

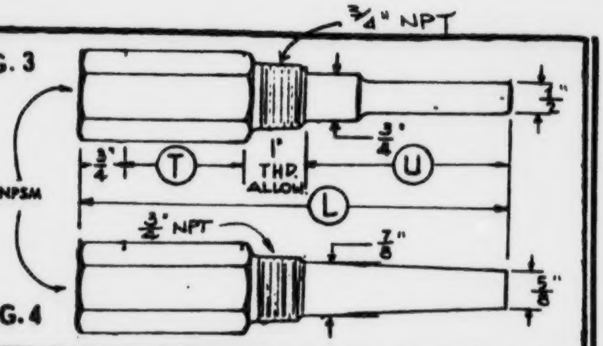

FIG. 4

TAG NO.		TI-082	TI-109	TI-110			
SERVICE		PLANT COOL. WATER	COOL. WATER FROM TRANS. CONV NO. 2	COOL. WTR. FROM BED DRAIN COOLER			
		HEADER - TEMP.	- TEMP.	- TEMP.			
WELL FIG.		4	3	3			
MATERIAL	304SS	✓	✓	✓			
	316SS						
	OTHER						
CONSTRUCTION							
DRILLED BAR STOCK		✓	✓	✓			
BUILT-UP							
OTHER							
DIMEN.	"L"						
DIMEN. mm "T"		0	50	50			
	"U" mm	115	115	115			
BULB OR UNION THREAD SIZE							
FEMALE 1/2"		✓	✓	✓			
	OTHER						
THREAD SIZE							
MALE 3/4"		3/4" NPT	3/4" NPT	3/4" NPT			
	OTHER						
INDICATOR FIG.		2	2	2			
BULB TYPE:		BI-METALLIC	BI-METALLIC	BI-METALLIC			
THREADED		✓	✓	✓			
	PLAIN						
UNION							
	OTHER						
CASE MATERIAL: MFGR STD		✓	✓	✓			
	OTHER						
DIAL SIZE. 'D'		76mm (3")	76mm (3")	76mm (3")			
FORM: STRAIGHT							
	FIXED	✓	✓	✓			
ADJUSTABLE							
	ANGLE						
STEM LENGTH 'S'		AS REQ'D	AS REQ'D	AS REQ'D			
RANGE	°C	0-50	0-100	0-100			
FLUID		WATER	WATER	WATER			
PRESS: OPER.							
	MAX. kPa	700	700	700			
TEMP: OPER.		29	66	66			
	MAX.						
LINE SIZE & SCHED. OR VESSEL							
MANUFACTURER							
MODEL NO.							
NOTES							

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TEMPERATURE GAUGES
INSTRUMENT SPECIFICATION

A	0243		8727	0

1.	TAG NO.		LSH-121		LSL-076		
2.	SERVICE		COOLING TOWER REMOTE SUMP-LEVEL		COOLING TOWER REMOTE SUMP-LEVEL		
3.	SWITCH ACTUATION		FLOAT		FLOAT		
4.	MOUNTING:						
	SIDE	TOP	✓		✓		
	INSERTION	CAGE	✓		✓		
5.	PROCESS CONNECTION:						
	SIZE AND TYPE		2½" NPT		2½" NPT		
	LOCATION		VESSEL SIDE		VESSEL SIDE		
6.	BODY MATERIAL		CAST IRON		CAST IRON		
7.	FLOAT AND TRIM						
	MATERIAL		STAINLESS		STAINLESS		
	DIMENSIONS		MFGR STD		MFGR. STD		
8.	OUTPUT ACTION:						
	LEVEL RISES		SWITCH OPENS		SWITCH CLOSES		
9.	SWITCH:						
	QUANTITY	FORM	1	SPDT	1	SPDT	
	TYPE		MICROSWITCH		MICROSWITCH		
10.	SWITCH RATING						
	VOLTS	CY. OR D.C.		DC		DC	
	AMPS	WATTS					
	LOAD TYPE		NON-IND		NON-IND.		
11.	MINIMUM DIFFERENTIAL		25mm		25mm		
	FIXED	ADJUSTABLE	✓		✓		
12.	SERVICE CONDITIONS						
	FLUID		WATER		WATER		
	TEMP. OPER	TEMP MAX	29	66	29	66	
	PRESS OPER.	PRESS. MAX	ATMOS.		ATMOS		
	SPEC. GRAV.		1.0		1.0		
13	MANUFACTURER						
	MODEL NO						

NOTES:

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A	0243		8728	0

			FSL-111		FSL-112		FSL-113		FSL-114	
1.	TAG NO.									
2.	SERVICE		PLANT COOL. WATER		PLANT COOL WATER		PLANT COOL. WATER		PLANT COOL. WATER	
			FROM BAYONET		FROM BAYONET		FROM BAYONET		FROM BAYONET	
			TUBE NO 1 - FLOW		TUBE NO. 2 - FLOW		TUBE NO 3 - FLOW		TUBE NO. 4 - FLOW	
3.	SWITCH ACTUATION		SHUTTLE		SHUTTLE		SHUTTLE		SHUTTLE	
4.	MOUNTING:									
	INLINE UNIT	END CONN. SIZE	YES	1" NPT	YES	1" NPT	YES	1" NPT	YES	1" NPT
	VIA PIPE TEE OR FITTING	FITTING SIZE								
5.	LINE SIZE		25mm (1") Sch40		25mm (1") Sch.40		25mm (1") Sch.40		25mm (1") Sch 40	
6.	BODY MATERIAL		STAINLESS		STAINLESS		STAINLESS		STAINLESS	
7.	TRIM MATERIAL		STAINLESS		STAINLESS		STAINLESS		STAINLESS	
8.	OUTPUT ACTION:									
	FLOW INCREASES		SWITCH CLOSES		SWITCH CLOSES		SWITCH CLOSES		SWITCH CLOSES	
9.	SWITCH:									
	QUANTITY	FORM	1	SPDT	1	SPDT	1	SPDT	1	SPDT
	TYPE		①		①		①		①	
10.	SWITCH RATING:									
	VOLTS	CY. OR D.C		DC		DC		DC		DC
	AMPS	WATTS								
	LOAD TYPE		NON-IND		NON-IND		NON-IND		NON-IND	
11.	MINIMUM DIFFERENTIAL									
	FIXED	ADJUSTABLE	✓		✓		✓		✓	
12.	TRIP POINT ②		24	L/min	24	L/min	24	L/min	24	L/min
	FIXED	ADJUSTABLE	✓		✓		✓		✓	
	ADJUSTABLE RANGE									
13.	SERVICE CONDITIONS									
	FLUID		WATER		WATER		WATER		WATER	
	SPEC GRAV.		0.98		0.98		0.98		0.98	
	PRESS OPER	TEMP. OPER	400	66	400	66	400	66	400	66
	PRESS. MAX	TEMP MAX	620		620		620		620	
	PRESS. UNITS	TEMP UNITS	kPa	°C	kPa	°C	kPa	°C	kPa	°C
14.	MANUFACTURER		GEMS		GEMS		GEMS		GEMS	
	MODEL NO.		27065		27065		27065		27065	

NOTES: ① MAGNETICALLY ACTUATED REED RELAY
② 24 L/min = 6 GPM

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FLOW SWITCHES
INSTRUMENT SPECIFICATION

A	0243		8729	0

1.	TAG NO		NOTE ①	
2.	SERVICE		COMBUSTOR TAPPING POINT PURGES	
3.	FUNCTION		INDICATE + CONTROL	
4.	MOUNTING		NOTE ②	
5.	CONNECTION SIZE TYPE		1/4" NPT	
6.	FITTING MATERIAL		BRASS	
7.	METER:			
	SIZE			
	TUBE MAT'L	FLOAT MAT'L	GLASS	STD.
	SCALE LENGTH + TYPE		65mm DETACHABLE	
	METER SCALE RANGE		30-300 L/hr ③	
	METER FACTOR		DIRECT READING	
8.	FLOW CONTROLLER:			
	CONSTANT DIFF'L RELAY		YES	
	INTEGRALLY MOUNTED		YES ④	
	BODY MATERIAL		BRASS	
	TRIM MATERIAL		STD.	
	NEEDLE VALVE		INTEGRAL TO PURGE METER	
9.	PURGE MEDIUM:		INSTRUMENT AIR	
	INLET PRESS.		⑤	
	TEMP.			
	RELATIVE DENSITY		1.00 (AIR)	
	DOWNSTREAM PRESSURE		①	
10.	MANUFACTURER			
	MODEL NO.			
	TUBE MODEL NO			
	FLOAT MODE NO.			

TAG NO.	DOWNSTREAM PRESS. kPa
FI-043	25 TO 45
FI-052	0 TO 45
FI-118A	-2 TO 0
FI-118B	-5 TO 0
FI-062	-2 TO -6
FI-066	-3 TO -6
FI-070	-3 TO -6

NOTE: FOLLOWING CLARIFICATION BY THE COMBUSTOR SUPPLIER THE RANGE ON FI-043/052/118A/118B MAY NEED CHANGING

① SEE TABLE AT RIGHT FOR TAG NUMBERS AND DOWNSTREAM PRESSURE RANGES
② MOUNTING BRACKET FOR SURFACE MOUNTING SHALL BE INCLUDED
③ SCALE SHALL BE DIRECT READING EITHER 30-300 Liter/hour OR 0.5 - 5 Litre/min (EQUALS APPROX. 1 - 10 CFH)
④ INSTALLED TO METER CONSTANT AIR FLOW RATE WITH CONSTANT UPSTREAM PRESSURE AND VARIABLE DOWNSTREAM PRESSURE.
⑤ INLET FILTER PRESSURE REGULATOR WILL BE SUPPLIED TO SUPPLY ALL PURGEMETERS RANGE 0-240 kPa VENDOR SHALL INDICATE REQ'D PRESSURE SETTING

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PURGE METERS

INSTRUMENT SPECIFICATION

A	0243		8730	0

GENERAL	1.	Tag No.		PCV-122	
	2.	Service		①	
	3.	Line No./Vessel No.			
	4.	Line Size/Sched. No.			
	5.	Function		PRESS. REDUCING	
BODY	6.	Type of Body		GLOBE	
	7.	Body Size	Port Size	STD.	STD.
	8.	Guiding	No. of Ports	STD	1
	9.	End Conn. & Rating		1/4" NPT	
	10.	Body Material		BRASS	
	11.	Packing Material		STD	
	12.	Lubricator	Iso. Valve		
	13.	Seal Type			
	14.	Trim Form			
	15.	Trim Material		STD.	
	16.	Seat Material		STD.	
	17.	Required Seat Tightness			
	18.	Max. Allow Sound Level dBA			
ACTUATOR/ PILOT	19.	Type of Actuator		SPRING TYPE	
	20.	Pilot			
	21.	Supply to Pilot			
	22.	Self Cont.	Ext. Conn.	✓	
	23.	Diaphragm Material		STD.	
	24.	Diaphragm Rating			
	25.	Spring Range ②		35-240 kPa	
	26.	Set Point ③		100 kPa	
	27.	SQUARE HEAD ADJ. SCREW		YES	
ACCESSORIES	28.	Filt. Reg.	Supply Gage		
	29.	Line Strainer			
	30.	Housing Vent			
	31.	Internal Relief			
	32.	FILTER		INTEGRAL	
	33.	OUTPUT GAGE		0-400 kPa	
SERVICE	34.	FLOW UNITS ④		L/hr	
	35.	Fluid		INSTR. AIR	
	36.	Quant. Max.	C_v	2100	
	37.	Quant. Oper.	C_v	1000	
	38.	Valve C_v	Valve F_L		
	39.	Norm. Inlet Press.	ΔP	620	kPa
	40.	Max. Inlet Press.			
	41.	Max. Shut Off	ΔP		
	42.	Temp. Max.	Operating		
	43.	Oper. sp. gr.	Mol. Wt.	1.00	29.0
	44.	Oper Visc.	% Flash		
	45.	% Superheat	% Solids		
	46.	Vapor Press.	Crit. Press.		
	47.	Predicted Sound Level dBA			
	48.	Manufacturer		FISHER	
	49.	Model No.		67FR-206	

Notes:

① INSTRUMENT TAPPING POINTS PURGE AIR - PRESSURE

② 5-35 psi

③ PRELIMINARY ONLY

④ 2100 L/hr = 74 CFH, 1000 L/hr = 35CFH

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PRESSURE REGULATOR
INSTRUMENT SPECIFICATION

A	0243		8731	0

		INSTRUMENT TAG NUMBER	UI-1		UI-2		UI-3		UI-4 ⑦	
INDICATORS	**SCALE**	**SINGLE OR DUAL**	DUAL		DUAL		DUAL		DUAL	
		RANGE SCALE: 1 | 2	0-50	0-50	0-8	0-25	0-(-6)	0-(-6)	0-2	0-25
		LINEAR OR OTHER SCALE: 1 | 2	LIN.	LIN.	LIN.	LIN.	LIN.	LIN.	LIN.	LIN.
		UNITS SCALE: 1 | 2	kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa
		STRIP OR OTHER								
		VERTICAL OR HORIZONTAL	VERT.		VERT.		VERT.		VERT.	
	CASE	**MAXIMUM HEIGHT**								
		MAXIMUM WIDTH								
		MAXIMUM DEPTH								
		COLOUR								
	INPUT	**NO. 1: TAG NUMBER**	PI-008		PDI-064		PI-062		PDI-070	
		- RANGE & UNITS	4-20mADC		4-20 mADC		4-20 mADC		4-20mADC	
		NO. 2: TAG NUMBER	PI-043		PDI-065		PI-066		PDI-118	
		RANGE & UNITS	4-20mADC		4-20 mADC		4-20 mADC		4-20mADC	
		MOVEMENT: ELECTRONIC OR OTHER	TBA:							
		INDICATOR: BAR GRAPH OR OTHER	TBA:							
		POWER SUPPLY	120V 60Hz ②		120V 60Hz ②		120V 60Hz ②		120V 60Hz ②	
		ALARM CONTACTS	—		—		—		—	
		TRANSMITTER POWER SUPPLY	①		①		①		①	
ACCESS.		**MOUNTING HARDWARE**	③		③		③		③	
		NAMEPLATES	④		④		④		④	
		CONTACT OUTPUT FOR ALARM:								
		-(HIGH) INPUT 1 | 2	—	—	—	YES ⑤	—	YES ⑤	—	—
		-(LOW) INPUT 1 | 2	YES ⑤	YES ⑤	—	YES ⑤	—	—	—	—
LOCATION		**CONTROL ROOM OR OTHER**	CONTROL ROOM		CONTROL ROOM		CONTROL ROOM		CONTROL ROOM	

④ INDICATOR SHALL HAVE A NAMEPLATE, AFFIXED TO ITS FRONT FACE, BEARING TAG NOS. FOR LEFT AND RIGHT CHANNELS.

⑤ SPDT OUTPUT. SETPOINT WILL BE ADVISED LATER.

NOTES.

① INDICATOR SHALL BE CAPABLE OF PROVIDING POWER SUPPLY TO 2-WIRE TRANSMITTERS. (SWITCH SELECTABLE TO ALLOW SELF POWERED TRANSMITTERS ALSO.

② IF INDICATOR IS DC POWERED THEN POWER SUPPLY AND DISTRIBUTION PANEL(S) TO SERVE UI-1 TO UI-9 SHALL BE INCLUDED. POWER SUPPLY AND DISTRIBUTION PANELS SHALL BE SUITABLE FOR MOUNTING IN REAR OF PANEL.

③ AN INSTRUMENT SHELF WITH ROOM FOR ALL 9 INDICATORS, PLUS A 10th SPARE LOCATION WITH FILLER PLATE, SHALL BE INCLUDED C/W ALL MOUNTING HARDWARE FOR PANEL MOUNTING.

⑦ UI-4 RANGE CHANGED AFTER ISSUE OF INQUIRY

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INDICATORS
INSTRUMENT SPECIFICATION

A	0243		8732	0

		INSTRUMENT TAG NUMBER	UI-9	
INDICATORS	SCALE	SINGLE OR DUAL	DUAL	
		RANGE SCALE: 1 | 2	0-100	0-100
		LINEAR OR OTHER SCALE: 1 | 2	LIN.	LIN.
		UNITS SCALE: 1 | 2	°C	°C
		STRIP OR OTHER		
		VERTICAL OR HORIZONTAL	VERT.	
	CASE	MAXIMUM HEIGHT		
		MAXIMUM WIDTH		
		MAXIMUM DEPTH		
		COLOUR		
	INPUT	NO. 1: TAG NUMBER	TI-091	
		RANGE & UNITS	4-20mADC	
		NO. 2: TAG NUMBER	TI-104	
		RANGE & UNITS	4-20mADC	
		MOVEMENT: ELECTRONIC OR OTHER	TBA:	
		INDICATOR: BAR GRAPH OR OTHER	TBA:	
		POWER SUPPLY	120V 60Hz②	
		ALARM CONTACTS	—	
		TRANSMITTER POWER SUPPLY	①	
ACCESS.		MOUNTING HARDWARE	③	
		NAMEPLATES	④	
		CONTACT OUTPUT FOR ALARM:		
		-(HIGH) INPUT 1 | 2	—	—
		-(LOW) INPUT 1 | 2	—	—
LOCATION		CONTROL ROOM OR OTHER	CONTROL ROOM	

④ INDICATOR SHALL HAVE A NAMEPLATE, AFFIXED TO ITS FRONT FACE, BEARING TAG NOS. FOR LEFT AND RIGHT CHANNELS.

NOTES.

① INDICATOR SHALL BE CAPABLE OF PROVIDING POWER SUPPLY TO 2-WIRE TRANSMITTERS. (SWITCH SELECTABLE TO ALLOW SELF POWERED TRANSMITTERS ALSO.)

② IF INDICATOR IS DC POWERED THEN POWER SUPPLY AND DISTRIBUTION PANEL(S), TO SERVE UI-1 TO UI-9, SHALL BE INCLUDED. POWER SUPPLY AND DISTRIBUTION PANELS SHALL BE SUITABLE FOR MOUNTING IN REAR OF PANEL.

③ AN INSTRUMENT SHELF WITH ROOM FOR ALL 9 INDICATORS, PLUS A 10th SPARE LOCATION WITH FILLER PLATE, SHALL BE INCLUDED C/W ALL MOUNTING HARDWARE FOR PANEL MOUNTING.

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INDICATORS
INSTRUMENT SPECIFICATION

A	0243	8733	0

		INSTRUMENT TAG NUMBER	UI-5		UI-6		UI-7		UI-8	
INDICATORS	**SCALE**	**SINGLE OR DUAL**	DUAL		DUAL		DUAL		DUAL	
		RANGE SCALE: 1 | 2	-10 TO 40	200-1200	200-1200	400-1000	100-300	0-100	0-100	0-100
		LINEAR OR OTHER SCALE: 1 | 2	LIN.	LIN.	LIN	LIN.	LIN	LIN.	LIN.	LIN.
		UNITS SCALE: 1 | 2	kPa	°C	°C	°C	°C	(NONE)	°C	(NONE)
		STRIP OR OTHER								
		VERTICAL OR HORIZONTAL	VERT.		VERT.		VERT.		VERT.	
	CASE	**MAXIMUM HEIGHT**								
		MAXIMUM WIDTH								
		MAXIMUM DEPTH								
		COLOUR								
	INPUT	**NO. 1: TAG NUMBER**	PI-052		TI-053		TI-067		TI-088	
		RANGE & UNITS	4-20mADC		4-20mADC		4-20mADC		4-20mADC	
		NO. 2: TAG NUMBER	TI-123		TI-063		SPARE		SPARE	
		RANGE & UNITS	0-10VDC		4-20mADC		4-20mADC		4-20mADC	
		MOVEMENT: ELECTRONIC OR OTHER	TBA:							
		INDICATOR: BAR GRAPH OR OTHER	TBA:							
		POWER SUPPLY	120V60Hz ②		120V 60Hz ②		120V60Hz ②		120V 60Hz ②	
		ALARM CONTACTS	—		—		—		—	
		TRANSMITTER POWER SUPPLY	①		①		①		①	
ACCESS.		**MOUNTING HARDWARE**	③		③		③		③	
		NAMEPLATES	④		④		④		④	
		CONTACT OUTPUT FOR ALARM:								
		- (HIGH) INPUT 1 | 2	—	—	—	—	—	—	—	—
		- (LOW) INPUT 1 | 2	—	—	—	—	—	—	—	—
LOCATION		**CONTROL ROOM OR OTHER**	CONTROL ROOM		CONTROL ROOM		CONTROL ROOM		CONTROL ROOM	

④ INDICATOR SHALL HAVE A NAMEPLATE, AFFIXED TO ITS FRONT FACE, BEARING TAG NOS FOR LEFT AND RIGHT CHANNELS

NOTES.

① INDICATOR SHALL BE CAPABLE OF PROVIDING POWER SUPPLY TO 2-WIRE TRANSMITTERS. (SWITCH SELECTABLE TO ALLOW SELF POWERED TRANSMITTERS ALSO.)

② IF INDICATOR IS DC POWERED THEN POWER SUPPLY AND DISTRIBUTION PANEL(S), TO SERVE UI-1 TO UI-9, SHALL BE INCLUDED. POWER SUPPLY AND DISTRIBUTION PANELS SHALL BE SUITABLE FOR MOUNTING IN REAR OF PANEL.

③ AN INSTRUMENT SHELF WITH ROOM FOR ALL 9 INDICATORS, PLUS A 10TH SPARE LOCATION WITH FILLER PLATE, SHALL BE INCLUDED C/W ALL MOUNTING HARDWARE FOR PANEL MOUNTING.

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SCALE		**DATE**
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INDICATORS
INSTRUMENT SPECIFICATION

A	0243		8734	0

TAG NUMBER	RECORDER	UR-1	UR-2	
	PEN 1	FR-004	FR-023	
	PEN 2	FR-007	FR-027	
	PEN 3	FR-010	SPARE	
	MULTI-POINT			
QTY. OF PENS OR MULTIPOINT		3 PENS	3 PENS	
CHART	ROLL OR OTHER	ROLL	ROLL	
	SPEED: mm/HR. | ADJUSTABLE	20mm/hr | NO	20mm/hr | NO	|
	DURATION @ mm/HR. ABOVE			
	RANGE: PEN 1	0-1600 kg/hr	0-400 kg/hr	
	RANGE: PEN 2	0-1000 kg/hr	0-50 kg/hr	
	RANGE: PEN 3	0-1000 kg/hr	0-100	
	RANGE: MULTIPOINT			
SCALE	COMMON UNITS			
	PEN 1: UNITS	0-1600 kg/hr	0-400 kg/hr	
	PEN 2: UNITS	0-1000 kg/hr	0-50 kg/hr	
	PEN 3: UNITS	0-1000 kg/hr	0-100	
	MULTI-POINT			
	WIDTH			
INPUT	PEN 1	0-10VDC	4-20mADC	
	PEN 2	0-10VDC	4-20mADC	
	PEN 3	0-10VDC	①	
	MULTI-POINT			
TRACE	NUMBER OR DOT			
	COLOUR: PEN | 1 | 2 | 3 |	RED | GREEN | BLUE |	RED | GREEN | BLUE |	| | |
CASE	MAXIMUM HEIGHT	150 mm NOMINAL	150mm NOMINAL	
	MAXIMUM WIDTH	150 mm NOMINAL	150mm NOMINAL	
	MAXIMUM DEPTH	600 mm	600mm	
	COLOUR			
	CEMA TYPE			
RECORDER	ALARM CONTACTS	N/A	N/A	
	TYPE			
	POWER SUPPLY	120 V, 60Hz	120V, 60Hz	
	BURN OUT DIRECTION			
ACCESSORIES	MOUNTING HARDWARE	②	②	
	SPARE PENS	1 SET	1 SET	
	CHART PAPER	60 DAYS	60 DAYS	
	NAMEPLATES	③	③	
	MANUFACTURER			
	MODEL NO.			

NOTES

① SPARE CHANNEL SHALL BE AVAILABLE FOR EITHER 0-10VDC OR 4-20mADC.

② AN INSTRUMENT SHELF WITH ROOM FOR A TOTAL OF 5 RECORDERS SHALL BE PROVIDED COMPLETE WITH MOUNTING HARDWARE, AND FILLER PLATES FOR THE THREE RECORDER SIZED SPACES NOT BEING USED.

③ NAMEPLATE MOUNTED ON RECORDER DOOR SHALL BE INCLUDED. NAMEPLATE SHALL CONSIST OF 3 LINES. EACH LINE WILL REFER TO ONE PEN BY COLOUR AND HAVE UP TO 40 CHARACTERS FOLLOWING TO DEFINE THE CHANNEL (WORDING WILL BE ADVISED LATER BUT WILL INCLUDE TAG NO. SERVICE DESCRIPTION AND RANGE)

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RECORDERS
INSTRUMENT SPECIFICATION

A	0243		8735	0

			TAG NUMBER	TT- ①	TT- ①	TT- ①	
TRANSMITTER			RANGE: C	200-1200	200-1200	200-1200	
			SENSING ELEMENT	TYPE K TH.CPL.	TYPE K TH.CPL	TYPE K TH.CPL	
			SINGLE OR MULTIPLE ELEMENT	SINGLE	SINGLE	SINGLE	
			SUPPLY REQUIREMENTS	2 WIRE	2 WIRE	2 WIRE	
			SUPPLY METER OR GAUGE	—	—	—	
			OUTPUT	4-20mA	4-20mA	4-20mA	
			OUTPUT METER OR GAUGE	—	—	—	
			PROCESS TEMPERATURE INDICATOR	—	—	—	
			OVER-RANGE PROTECTION	—	—	—	
			ZERO SUPPRESSION	—	—	—	
			ENCLOSURE: CEMA TYPE	②	②	②	
			ELEC. CONN.: SIZE | THD. OR K/O	1/2"	1/2"	1/2"	
			MEASURING JUNCTION	GROUNDED	GROUNDED	GROUNDED	
SENSING ELEMENT			T/W: REFER TO SPEC.:	BY OTHERS	BY OTHERS	BY OTHERS	
			ELEMENT: REFER TO SPEC.	BY OTHERS	BY OTHERS	BY OTHERS	
	FILLED SYSTEM		CLASS				
		BULB	MATERIAL				
			STRAIGHT OR COILED				
			BENDABLE EXTENSION				
			PLAIN OR UNION				
			INSERTION LENGTH				
			DIST. ABOVE/ BELOW INSTR.				
		CAPIL-LARY	MATERIAL				
			LENGTH				
		ARMOR	MATERIAL				
			COVER MTL. (IF ANY)				
ACCESS.			MOUNTING BRACKET & HARDWARE	FOR 50mm PIPE	FOR 50mm PIPE	FOR 50mm PIPE	
			FILTER REGULATOR				
PROCESS			FLUID	FLUIDIZED BED	FLUIDIZED BED	FLUIDIZED BED	
	FLUID		FLOW: RATE & UNITS				
			PRESS.: UNITS				
			TEMPERATURE: UNITS	1100 °C	1100 °C	1100 °C	
			MANUFACTURER ③	ROSEMOUNT	ROSEMOUNT	ROSEMOUNT	
			MODEL NO. ③	444-TK3-D1-A2, EB	444-TK3-D1-A2, EB	444-TK3-D1-A2, EB	

NOTES.

① TAG NUMBERS WILL BE ADVISED LATER.

② CSA EXPLOSIONPROOF CERTIFICATION CLASS I GROUP C, D, CLASS II GROUP E, F, G

③ OR EQUAL

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TEMPERATURE TRANSMITTERS
INSTRUMENT SPECIFICATION

A	0243		8736	

GENERAL

1 Tag No. UA-1 Location: CONTROL ROOM PANEL (VERTICAL FACE)
2 Cabinet Size: 4 ROWS Rows High By 7 COLUMNS Columns Wide
3 Mounting: Flush Panel ☒ Surface ☐
4 Cabinet Style: Plug-In Light Boxes ☒ Swing Door ☐ Remote Logic Cabinet ☐ Watertight Door ☐
5 Rating: General Purpose ☒ Weather proof ☐ Explosion proof ☐ Class ____ Group ____ Division ____
6 Power Supply: 117V 60Hz ☒ 125 Vdc ☐ 12 Vdc ☐ 24 Vdc ☐ Other:

DISPLAY

7 Backlighted Nameplates: White Translucent ☒ Other: ____ Size: APPROX. 2½" TO 3" SQUARE
8 Alarm Points Per Lightbox: One ☐ Two ☐ Three ☐ Four ☐ NOTE ①
Lamps Per Alarm: One ☐ Two ☒ Three ☐ Four ☐
9 Bullseye Type: Number of Lights: ____ Color: ____
10 Other Display:

LOGIC

11 Logic: Electro-Mechanical Relay ☐ Solid-State Electronic ☒ Mercury Bottle ☐ Fluidic ☐
12 In Display Cabinet ☒ Remote Cabinet ☐ Strip Chassis ☐
13 General Purpose ☒ Weather proof ☐ Explosion proof ☐ Class ____ Group ____ Division ____ Intrinsically Safe ☐
14 Field Contact Voltage: 117 Vac ☐ 12 Vdc ☒ 125 Vdc ☐ Other:
15 On Alarm, Actuating Contacts: [✓ Open] Close Field Selectable Form

FEATURES

16 Required Features: Lock-In of Momentary Alarms ☒ Auxiliary Contacts ☐ Sequential Alarm Circuit ☐
17 Ring-Back Circuit: Via Alarm Audible Signal ☐ Via Other Audible Signal ☐
18 Fail-Safe Circuit to Signal Own Failure ☐ Operational Test ☒ Lamp Test ☐
19 Flasher: Remote ☐ In Cabinet ☒ Model No.:
NOTE ② 20 Acknowledge Common ☐ Unit ☐ Light ☐ Audible ☐ PB Location in Cabinet ☐ Remote ☒ Others ☐
21 Reset ← AUTOMATIC Common ☐ Unit ☐ Light ☐ Audible ☐ PB Location in Cabinet ☐ Remote ☐ Others ☐

SEQUENCE

22

STAGE	VISUAL SIGNAL	AUDIBLE SIGNAL
Normal	OFF	OFF
Alert, Initial	ON - FLASHING	ON
Alert, Subsequent	ON - FLASHING	ON
Acknowledge, Int.	ON - STEADY	OFF
Acknowledge, Subs.	ON - STEADY	OFF
Return to Normal	OFF	OFF
Reset	(AUTOMATIC RESET)	
Test	FLASHING	ON
ISA Sequence Number:	A	

OPTIONS

23 Horn: GENERAL PURPOSE FOR MOUNTING IN PANEL.
24 Bell:
25 Dimmer:
26 Color Caps:
27 Power Supply Location IN BACK OF PANEL
28
29 Manufacturer: Model No.

Notes: ① TOTAL 28 ALARM MODULES (43 POINTS): 15 TWIN POINT MODULES (FOR 30 POINTS) 13 SINGLE POINT MODULES (FOR 13 POINTS). SEE "ANNUNCIATOR LAYOUT" A-0243-8501 FOR LAYOUT OF MODULES AND ENGRAVING OF WINDOWS.

② ACKNOWLEDGE AND TEST P.B TO BE MOUNTED ON PANEL NEAR ANNUNCIATOR

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ANNUNCIATOR
INSTRUMENT SPECIFICATION

A	0243		8738	0

GENERAL	1	Tag Number		FI-011		FI-012	FI-013	FI-014
	2	Service		SECONDARY AIR TO ZONE 1 - FLOW		SECONDARY AIR TO ZONE 2 - FLOW	SECONDARY AIR TO ZONE 3 - FLOW	SECONDARY AIR TO ZONE 4 - FLOW
	3	Line No./Vessel No.						
	4	Function		INDICATE				
	5	Mounting		IN LINE (PIPE)				
	6	Power Supply		—				
	7	Conn. Size	Type	2"	NPT			
	8	Inlet Dir.	Outlet Dir.	VERT.	VERT.			
	9	Fitting Material		CARBON STEEL				
	10	Packing or O-Ring Mtl.		STD.				
	11	Enclosure Type		SIDE PLATE				
METER	12	Size ①	Float Guide	13	FLUTES			
	13	Tube Mtl.	Float Mtl.	GLASS	ST. STL			
	14	Meter Scale: Length & Type		250mm (10")				
	15	Meter Scale Range ①		0-350 kg/hr				
	16	Meter Factor		DIRECT RDG. SCALE				
	17	Rated Accuracy						
	18	Hydraulic Calib. Required						
FLUID DATA	19	Fluid		AIR				
	20	Color or Transparency		–				
	21	Maximum Flow Rate ①		350 kg/hr				
	22	Norm Flow	Min Flow	200	35			
	23	Oper. Specific Gravity (Liq)						
	24	Max Oper. Viscosity						
	25	Oper. Press.	Oper. Temp.	31.0 kPa	66°C	SPEC. IDENTICAL TO FI-011	SPEC. IDENTICAL TO FI-011	SPEC. IDENTICAL TO FI-011
	26	Oper. Density (Gases)		1.00 AIR				
	27	Std. Density	Mol. Wgt.		29.0			
	28	Max. Allowable Press. Drop		7 kPa				
	29							
EXT	30	Extension Well Mtl.						
	31	Gasket Mtl.						
XMTR	32	Transmitter Output						
	33	Trans. Enclosure Class						
	34	Scale Range						
ALARM	35	No. of Contacts	Form					
	36	Rating	Housing					
	37	Action						
	38							
OPTIONS	39	Valve Size & Material		BY OTHERS				
	40	Valve Location		DOWNSTREAM				
	41	Const. Diff. Relay Mtl.		—				
	42	Purge Meter Tubing		—				
	43	Airset		—				
	43a							
	44	Manufacturer ①		BROOKS				
	45	Model Number ①		1114				
	46	Tube Number ①		R13-M-25-3				
	47	Float Number ①		13-RS-510				

Notes: ALTERNATELY: WALLACE AND TIERNAN VAREA GLASS TUBE TYPE
2" SIZE ... TUBE WT-2-40-610
FLOAT 264-NVI-225
SCALE 0-375 kg/hr

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ROTAMETERS
INSTRUMENT SPECIFICATION

A	0243		8739	0

GENERAL	1	Tag Number	FI-015			
	2	Service	SECONDARY AIR TO ZONE 5 - FLOW			
	3	Line No./Vessel No.				
	4	Function				
	5	Mounting				
	6	Power Supply				
	7	Conn. Size / Type				
	8	Inlet Dir. / Outlet Dir.				
	9	Fitting Material				
	10	Packing or O-Ring Mtl.				
	11	Enclosure Type				
METER	12	Size / Float Guide				
	13	Tube Mtl. / Float Mtl.				
	14	Meter Scale: Length & Type				
	15	Meter Scale Range				
	16	Meter Factor				
	17	Rated Accuracy				
	18	Hydraulic Calib. Required				
FLUID DATA	19	Fluid				
	20	Color or Transparency				
	21	Maximum Flow Rate				
	22	Norm Flow / Min Flow				
	23	Oper. Specific Gravity (Liq)				
	24	Max Oper. Viscosity				
	25	Oper. Press. / Oper. Temp.				
	26	Oper. Density (Gases)				
	27	Std. Density / Mol. Wgt.				
	28	Max. Allowable Press. Drop				
	29					
EXT	30	Extension Well Mtl.				
	31	Gasket Mtl.				
XMTR	32	Transmitter Output				
	33	Trans. Enclosure Class				
	34	Scale Range				
ALARM	35	No. of Contacts / Form				
	36	Rating / Housing				
	37	Action				
	38					
OPTIONS	39	Valve Size & Material				
	40	Valve Location				
	41	Const. Diff. Relay Mtl.				
	42	Purge Meter Tubing				
	43	Airset				
	43a					
	44	Manufacturer				
	45	Model Number				
	46	Tube Number				
	47	Float Number				

SPEC. IDENTICAL TO FI-011
SEE A-0243-8739

Notes:

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APP'D.		

ROTAMETERS

INSTRUMENT SPECIFICATION

A	0243		8740	0

1.	POWER SUPPLY	
	- TAG NO.	UX-1
	- INPUT	120V 60Hz
	- OUTPUT	24 VDC ①
	• NO. OF LOOPS	MINIMUM 10
	• CURRENT	4-20mA DC
	- MOUNTING	REAR OF PANEL
	- CERTIFICATION	CSA
		NON-HAZARDOUS
		LOCATIONS
	- MANUFACTURER	FOXBORO
	MODEL NO.	P/N N0140AR
2.	DISTRIBUTION PANEL	
	- TAG NO.	UX-1A
	- FOR LOOPS 1	089
	② 2	096
	3	098
	4	100
	5	102
	6	SPARE
	7	↓
	8	
	9	
	10	SPARE
	- MOUNTING	REAR OF PANEL
	- CERTIFICATION	CSA NON-
		HAZARDOUS
		LOCATIONS
	- MANUFACTURER	FOXBORO
	- MODEL NO	P/N N0140MA

① FULL LOAD OUTPUT 22VDC MINIMUM

② TERMINALS SUPPLIED FOR EACH OF 10 4-20mADC CURRENT LOOPS.
EACH OUTPUT INDIVIDUALLY FUSED

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SCALE		**DATE**
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LOOP POWER SUPPLY
INSTRUMENT SPECIFICATION

A	**0243**		8741	0

SPECIFICATION FOR SHARED (MICROPROCESSOR BASED) CONTROLLERS

1.0 REQUIREMENT

Tenders are invited for the supply of a microprocessor based controller.

2.0 SCOPE OF WORK

The work includes the supply of the controller(s) completely configured to accomplish the control scheme as indicated herein, and shall include, but not be limited to, the following:

- microprocessor based controller(s)
- controller power supply
- operator interface
- controller configuration and documentation
- six operating, configuring and maintenenace manuals.

3.0 DESIGN CONDITIONS

The controller(s) will be mounted in a vertical face freestanding panel (by others) located in the plant control room.

4.0 DESIGN DATA

This specification includes Instrument Schematics (see drawings B-0243-9201, 9202, 9203, 9204) and Shared Controller I/O Lists (see drawings A-0243-9001, 9002, 9003, 9004, 9005, 9006).

The Schematics employ ISA symbology as per ISA Standards S5.1 and S5.3. Major function blocks of the controller(s) are shown by balloons encased inside squares as per S5.3. The function blocks labelled "X ÷" provide pressure and temperature compensation for air flows. The function blocks labelled by "Σ " or sigma provide summation as follows:

. . . . FY-007B = (FY-017A) + (FY-018A)
FY-007A = (FY-004B) - (FY-010B) - (FY-007B)

The remaining blocks are self explanatory.

The I/O Lists identify the inputs and outputs and signal levels. Proposal shall include also for programming of some logic and interlocks which will be advised later.

5.0 TECHNICAL REQUIREMENTS

5.1 Input and output (to recorders etc.) signal ranges and engineering units will be advised later.

5.2 Signal inputs will consist of 4-20 m ADC from two wire transmitters and some self powered transmitters. Contact inputs will be unpowered.

The controller shall be capable of supplying power to the two-wire transmitters (estimated input loop resistances given on I/O Lists)

5.3 Signal outputs shall consist of 4-20 m ADC control outputs and 0-10 VDC or 4-20 m ADC recording outputs. Contact outputs shall be unpowered.

5.4 The operator interface shall enable the operator to maintain control of the process without the use of a C.R.T. based interface. Process variable, setpoint and output information shall be readily accessible. Dedicated manual output stations and Auto-Manual Selectors shall be assigned to each output listed as "control" on the I/O Lists. These dedicated stations shall bear a nameplate listing: tag no. and/or service and control range.

The wording of the inscription and control range will be advised. Access to configuration shall be by key lock only.

6.0 ALTERNATIVES AND EXTRAS

6.1 The bidder is requested to clearly state and separately price any alternative or extra components he may feel are appropriate either for performance or reliability considerations.

6.2 An additional price is to be quoted for a permanent memory storage device which will allow saving and reloading or changing of configurations.

6.3 An additional price is to be quoted for field startup assistance including operator training.

7.0 STANDARDS AND CODES

Equipment shall be designed and fabricated in accordance with the laws and regulations of the Province of Ontario and with the latest edition of the following codes:

Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
Electrical and Electronic Manufacturers Association of Canada	EEMAC
Scientific Apparatus Makers Association	SAMA
Instrument Society of America	ISA

8.0 WARRANTY

The manufacturer shall warrant that all workmanship, materials and equipment shall be free from defects (including latent defects). The manufacturer or supplier shall correct at his own expense any defects in the work (including latent defects) due to faulty materials or workmanship which appear prior to the end of one year from the date such materials and equipment are utilized or placed into operation by the company, whichever is applicable.

Notwithstanding the provisions set forth above, if any statute in force in the Province of Ontario creates a more extended liability for faulty materials or workmanship, the provisions of such statute shall apply.

1.	TAG NO.	HC-200
2.	SERVICE	COMBUSTION
		CONTROLS (ENERGY
		INPUT DEMAND
3.	OUTPUT INDICATION	100mm VERT.
		SCALE
4.	SCALE CALIBRATION	(TBA)
5.	OUTPUT SIGNAL	0-10 VDC ①
6	POWER SUPPLY	120V 60Hz
7	NAMEPLATE	LINE 1:
		HC-200
		LINE 2:
		PLANT MASTER
		SETPOINT
8.	LOCATION	CONTROL ROOM
		PANEL
9.	ACCESSORIES	
	- INSTRUMENT SHELF	ONE UNIT WIDE
10	MANUFACTURER	FOXBORO
	MODEL NO	E27MM-SA
		+ SHELF
		2025-01X

① 4-20mADC OPTIONALLY AVAILABLE

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SCALE		DATE
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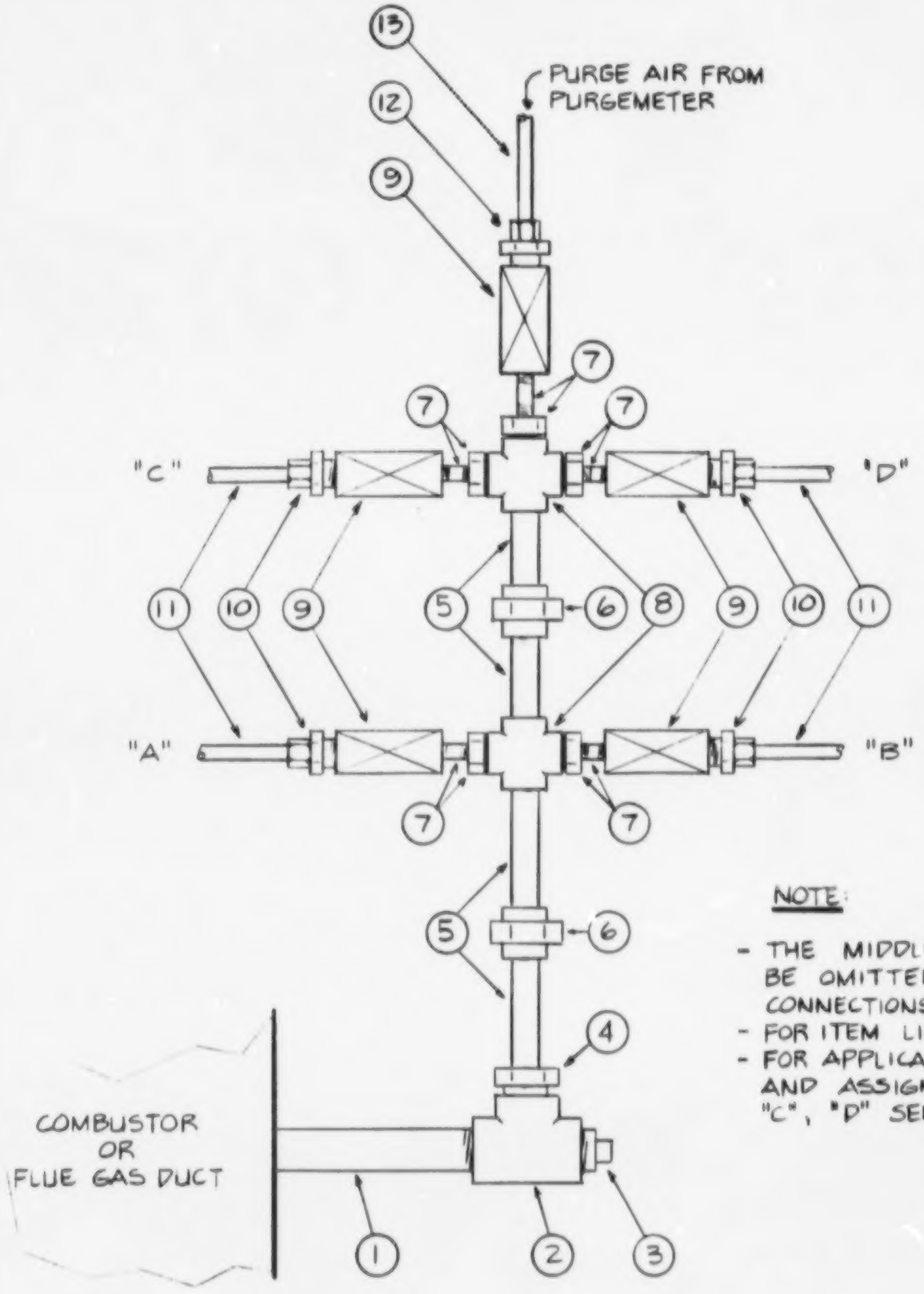
MANUAL STATION 1125

INSTRUMENT SPECIFICATION

A	0243		8743	0


13
12
9
PURGE AIR FROM PURGEMETER
7
7
7
"C"
'D"
11
10
9
5
6
8
9
10
11
"A"
"B"
7
7
5
6
4
COMBUSTOR OR FLUE GAS DUCT
1
2
3

NOTE:

- THE MIDDLE PIPING CROSS IS TO BE OMITTED IF ONLY TWO CONNECTIONS ARE REQUIRED
- FOR ITEM LIST SEE SHEET 2 OF 2
- FOR APPLICATION OF THIS DRAWING AND ASSIGNMENT OF "A", "B", "C", "D" SEE SHEET 2 OF 2

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SCALE	N.T.S.	**DATE**	
DRAWN	AF	2 DEC 1983	
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APP'D.			

PURGED PRESSURE TAPPING POINT

3126

INSTALLATION DETAIL

A	**0243**		8801	0

SHEET 1 OF 2

ITEM LIST

NO.	DESCRIPTION
1	TAPPING POINT SUPPLIED WITH COMBUSTOR
2	PIPE TEE SIZED TO SUIT ITEM 1. (SCR'D)
3	PIPE PLUG (INSPECTION & RODDING PORT)
4	REDUCING BUSHING IF REQ'D
5	1" PIPE NIPPLES (NOTE 1)
6	1" UNION
7	1/2" PIPE NIPPLE AND REDUCING BUSHING (1"NPT × 1/2"NPT)
8	1" PIPE CROSS
9	1/2" ROOT VALVE
10	STAINLESS STEEL MALE CONNECTOR 1/2" NPT × 3/8" TUBE
11	3/8" STAINLESS STEEL TUBING TO INSTRUMENT
12	BRASS MALE CONNECTOR 1/2" NPT × 1/4" TUBE
13	1/4" COPPER TUBING TO PURGEMETER

APPLICATION

TAPPING POINT LOCATION	ASSIGNMENTS AND VARIATIONS				
	"A"	"B"	"C"	"D"	
COMBUSTOR BOTTOM ABOVE PRIMARY AIR DISTRIBUTION NOZZLES	PDT-064 (L)	PT-043	PDT-065 (H)	TEST (NOTE 3)	
COMBUSTOR TOP NEAR OUTLET TO CYCLONE	PT-052	PSH-051	PDT-065 (L)	TEST (NOTE 3)	
CYCLONE OUTLET TO RECYCLE LOOP	(NOTE 2)	(NOTE 2)	PDT-118 (H)	TEST (NOTE 3)	
LOOP SEAL AERATION PORT	(NOTE 2)	(NOTE 2)	PDT-118 (L)	TEST (NOTE 3)	
CYCLONE FLUE GAS OUTLET	(NOTE 2)	(NOTE 2)	PT-062 (NOTE 5)	TEST (NOTE 3)	
FLUE GAS COOLER OUTLET	(NOTE 2)	(NOTE 2)	PT-066 (NOTE 5)	TEST (NOTE 3)	
BAGHOUSE INLET	PDT-070 (H) (NOTE 5)	PDSH-120 (H) (NOTE 5)	(NOTE 4)	TEST (NOTE 3)	

NOTES:

1. LOWER CROSS IS TO BE AT LEAST 600 mm ABOVE TAPPING POINT.
2. OMIT LOWER CROSS.
3. FOR TEST CONN. OMIT ITEMS 10, 11 AND INSTALL A PIPE PLUG IN ROOT VALVE OUTLET INSTEAD.
4. NOT USED. OMIT ITEMS 11, 10, 9, 7 AND INSTALL A PIPE PLUG IN CROSS OUTLET INSTEAD.
5. FLUE GAS PASSAGE TAPPING. OMIT ITEM 9, 7 AND INSTALL TUBING IN CROSS OUTLET DIRECTLY (USING SUITABLE REDUCING BUSHING)

ENERGY, MINES & RESOURCES CANADA

A R F B C RESEARCH FACILITY

1127

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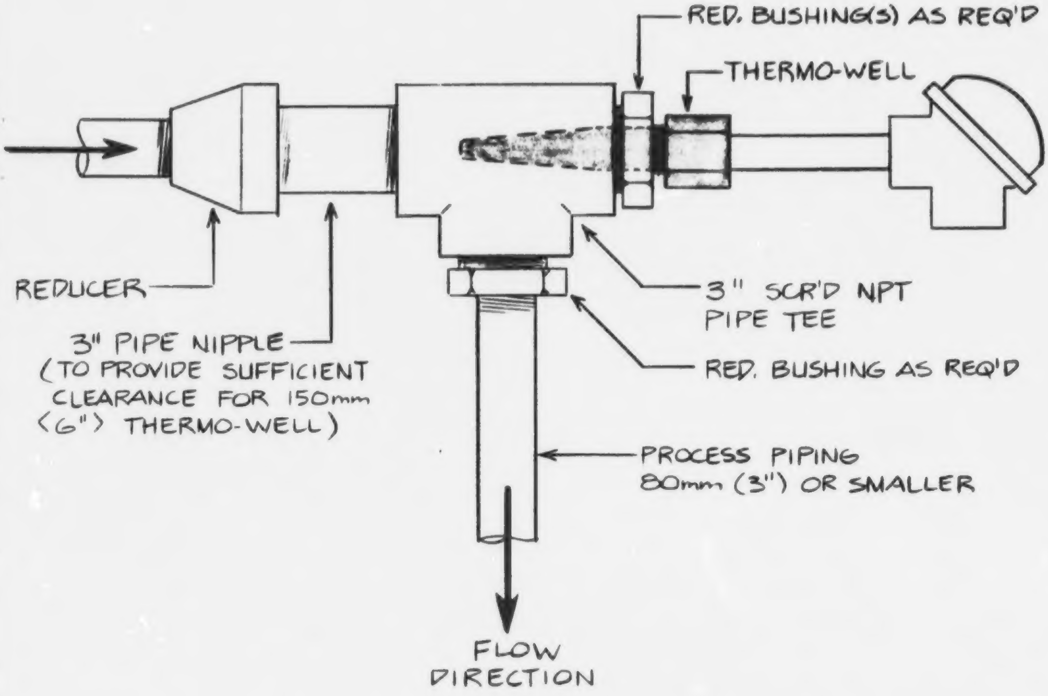
PURGED PRESSURE TAPPING POINT

INSTALLATION DETAIL

A	0243		8801	0

SHEET 2 OF 2


RED. BUSHING(S) AS REQ'D
THERMO-WELL
REDUCER
3" PIPE NIPPLE
(TO PROVIDE SUFFICIENT CLEARANCE FOR 150mm (6") THERMO-WELL)
3" SCR'D NPT PIPE TEE
RED. BUSHING AS REQ'D
PROCESS PIPING 80mm (3") OR SMALLER
FLOW DIRECTION

NOTES

1. THIS ARRANGEMENT SHALL APPLY IN ALL CASES WHERE PROCESS PIPING IS 80mm (3") SIZE OR SMALLER

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THERMO-WELL INSTALLATION IN SMALL SIZE LINES

INSTALLATION DETAIL

A 0243 8802 0

CONTROLLER: TAG NO. UIC-1 MAKE AND MODEL. WESTINGHOUSE 1500

LOCATION CONTROL ROOM PANEL

1. ANALOG INPUTS:

NO.	DEVICE TAG NO.	SIGNAL RANGE	CONTROLLER TERMINALS TB. NO.	+	-	SHLD.	LOOP POWER SUPPLY BY CONTROLLER YES	NO	INPUT LOOP RESISTANCE*	NOTES
1	PT-002	4-20mADC	2	1+	1-		✓		APPROX 600Ω	
2	TT-003	4-20 mADC	2	2+	2-		✓		" 700Ω	
3	FT-004	4-20mADC	2	3+	3-		✓		" 600Ω	
4	PT-009	4-20mADC	2	4+	4-		✓		" 600Ω	
5	FT-010	4-20mADC	2	5+	5-		✓		" 600Ω	
6	FY-007B	0-10 VDC	2	6+	6-			✓		①
7	SPARE		2	7+	7-					

*NOT INCLUDING CONTROLLER

2. DISCRETE INPUTS:

NO.	DEVICE TAG NO.	CONTACT STATUS OPEN	CLOSED	CONTROLLER TERMINALS TB. NO.	NO/NC	C		POWER SUPPLY BY CONTROLLER YES	NO	LEVEL	NOTES
1	SPARE										
2	"										
3	"										
4	"										
5	"										
6	"										
7	"										
8	"										
9	"										

NOTES: ① FY-007B IS OUTPUT 7 IN UIC-3 (SEE A-0243-9006)

ENERGY, MINES & RESOURCES
CANADA

A R F B C 1129
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SCALE		DATE
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APP'D.		

SHARED CONTROLLER I/O LIST - INPUTS

A | 0243 | | 9001 | 0

CONTROLLER: TAG NO. UIC-1 (CONT'D)

3. ANALOG OUTPUTS:

NO.	DESTINATION TAG NO.	SIGNAL RANGE	CONTROLLER TERMINALS TB. NO.	+	−	SHLD	OUTPUT TYPE CONTROL	RECORD	MANUAL BACK-UP YES	NO	OUTPUT LOOP RESISTANCE *	NOTES
1	PY-002	4-20mADC	3	1 +	1 −		✓		✓		APPROX. 176 Ω	
2	FY-010C	4-20mADC	3	2 +	2 −		✓		✓		" 176 Ω	
3	SPARE		3	3 +	3 −							
4	SPARE		3	4 +	4 −							
5	FR-004	0-10VDC	3	5 +	5 −			✓		✓	APPROX. 250 Ω	
6	FY-004C	0-10VDC	3	6 +	6 −		✓			✓	" 250 Ω	②
7	FR-010	0-10VDC	3	7 +	7 −			✓		✓	" 250 Ω	
8	FR-007	0-10VDC	3	8 +	8 −			✓		✓	" 250 Ω	

*NOT INCL. CONTROLLER

4. DISCRETE OUTPUTS: ③

NO.	DESTINATION TAG NO.	CONTACT STATUS OPEN	CLOSED	CONTROLLER TERMINALS TB. NO	NO	C	NC	POWERED BY CONTROLLER YES	NO	LEVEL	NOTES
1	FAL-007	ALARM	NORM.	4		1C			✓	24 VDC	
2	UIC-3	TRIP	NORM.	4		2C			✓		④
3	FAL-004	ALARM	NORM.	4		3C			✓	24 VDC	
4											
5											
6											
7	UIC-3	UNIT FAILURE	NORM	4		7C			✓		

NOTES: ② FY-004C IS INPUT 4 IN UIC-2 (SEE A-0243-9003)
③ CONTACTS ARE ALSO TO OPEN ON POWER FAILURE
④ OUTPUT IS FSL-007B

ENERGY, MINES & RESOURCES CANADA				**A R F B C** 1130 **RESEARCH FACILITY**	
integ Intercontinental Engineering Ltd	SCALE		DATE	**SHARED CONTROLLER I/O LIST - OUTPUTS**	
	DRAWN	AF	9NOV 1983		
	CHECK				
	APP'D.			A 0243	9002 0

CONTROLLER: TAG NO. UIC-2 MAKE AND MODEL. WESTINGHOUSE 1500

LOCATION CONTROL ROOM PANEL

1. ANALOG INPUTS:

NO.	DEVICE TAG NO.	SIGNAL RANGE	CONTROLLER TERMINALS TB. NO.	+	-	SHLD.	LOOP POWER SUPPLY BY CONTROLLER YES	NO	INPUT LOOP RESISTANCE*	NOTES
1	HC-200	0-10VDC	2	1+	1-			✓		
2	FT-023	4-20 mADC	2	2+	2-			✓		
3	FT-027	4-20 mADC	2	3+	3-			✓		
4	FY-004B	0-10 VDC	2	4+	4-			✓		①
5	PT-052	4-20mADC	2	5+	5-		✓		APPROX 850 Ω	
6	SPARE		2	6+	6-					
7	SPARE		2	7+	7-					

*NOT INCLUDING CONTROLLER

2. DISCRETE INPUTS:

NO.	DEVICE TAG NO.	CONTACT STATUS OPEN	CLOSED	CONTROLLER TERMINALS TB. NO.	NO/NC	C		POWER SUPPLY BY CONTROLLER YES	NO	LEVEL	NOTES
1											
2											
3											
4											
5											
6											
7											
8											
9											

NOTES: (1) FY-004B IS OUTPUT 6 IN UIC-1 (SEE A-0243-9002)

ENERGY, MINES & RESOURCES CANADA

A R F B C 1131
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SHARED CONTROLLER I/O LIST - INPUTS

A	0243		9003	0

CONTROLLER: TAG NO. UIC-2 (CONT'D)

3. ANALOG OUTPUTS:

NO.	DESTINATION TAG NO.	SIGNAL RANGE	CONTROLLER TERMINALS TB. NO.	+	-	SHLD	OUTPUT TYPE CONTROL	RECORD	MANUAL BACK-UP YES	NO	OUTPUT LOOP RESISTANCE *	NOTES
1	FY-004D	4-20mADC	3	1 +	1 -		✓		✓		APPROX. 176 Ω	
2	FK-023	4-20mADC	3	2 +	2 -		✓		✓		" TBA	
3	FK-027	4-20mADC	3	3 +	3 -		✓		✓		" TBA	
4	PY-052	4-20mADC	3	4 +	4 -		✓		✓		" 176 Ω	
5	SPARE		3	5 +	5 -							
6	SPARE		3	6 +	6 -							
7	SPARE		3	7 +	7 -							
8	SPARE		3	8 +	8 -							

* NOT INCL. CONTROLLER

4. DISCRETE OUTPUTS: ②

NO.	DESTINATION TAG NO.	CONTACT STATUS OPEN	CLOSED	CONTROLLER TERMINALS TB. NO	NO	C	NC	POWERED BY CONTROLLER YES	NO	LEVEL	NOTES
1	PAH-052	ALARM	NORM.	4		1C			✓	24 VDC	
2	PAL-052	ALARM	NORM.	4		2C			✓	24 VDC	
3											
4											
5											
6											
7	UIC-3	UNIT FAILURE	NORM	4		7C			✓		

NOTES: ② CONTACTS ARE ALSO TO OPEN ON POWER FAILURE

ENERGY, MINES & RESOURCES CANADA

A R F B C 3132

RESEARCH FACILITY

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SCALE		DATE
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SHARED CONTROLLER I/O LIST - OUTPUTS

A | 0243 | | 9004 | 0

CONTROLLER: TAG NO. UIC-3 MAKE AND MODEL. WESTINGHOUSE 1500

LOCATION CONTROL ROOM PANEL

1. ANALOG INPUTS:

	DEVICE	SIGNAL	CONTROLLER TERMINALS				LOOP POWER SUPPLY BY CONTROLLER			
NO.	TAG NO.	RANGE	TB. NO.	+	−	SHLD.	YES	NO	INPUT LOOP RESISTANCE*	NOTES
1	FT-017	4-20 mADC	2	1 +	1 −		✓		APPROX 600 Ω	
2	FT-018	4-20 mADC	2	2 +	2 −		✓		" 600 Ω	
3	TT-091	4-20 mADC	2	3 +	3 −		✓		" 950 Ω	
4	TT-104	4-20 mADC	2	4 +	4 −		✓		" 850 Ω	
5	TT- (TBA)	4-20 mADC	2	5 +	5 −		✓		" 700 Ω	
6	TT- (TBA)	4-20 mADC	2	6 +	6 −		✓		" 700 Ω	
7	TT- (TBA)	4-20 mADC	2	7 +	7 −		✓		" 700 Ω	

*NOT INCLUDING CONTROLLER

2. DISCRETE INPUTS:

	DEVICE	CONTACT STATUS		CONTROLLER TERMINALS				POWER SUPPLY BY CONTROLLER			
NO.	TAG NO.	OPEN	CLOSED	TB. NO	NO/NC	C		YES	NO	LEVEL	NOTES
1	PSH-051	TRIP	NORM	1	1	PC					
2	FD BLOWER	TRIP	NORM	1	2	PC					
3	IDFAN	TRIP	NORM	1	3	PC					
4	FSL-007B	TRIP	NORM	1	4	PC					
5	UIC-1 FAILURE	TRIP	NORM	1	5	PC					
6	UIC-2 FAILURE	TRIP	NORM	1	6	PC					
7	M.F.T. P.B. NO. 1	TRIP	NORM	1	7	PC					
8	M.F.T. P.B. NO 2	TRIP	NORM	1	8	PC					
9											

NOTES:

ENERGY, MINES & RESOURCES CANADA				**A R F B C RESEARCH FACILITY** 133
integ Intercontinental Engineering Ltd	SCALE		DATE	**SHARED CONTROLLER I/O LIST - INPUTS**
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	CHECK			
	APP'D.			A 0243 9005 0

CONTROLLER: TAG NO. UIC-3 (CONT'D)

3. ANALOG OUTPUTS:

	DESTINATION	SIGNAL	CONTROLLER TERMINALS				OUTPUT TYPE		MANUAL BACK-UP		OUTPUT LOOP	
NO.	TAG NO.	RANGE	TB. NO.	+	-	SHLD	CONTROL	RECORD	YES	NO	RESISTANCE *	NOTES
1	FY-017B	4-20mADC	3	1 +	1 -		✓		✓		APPROX. 176Ω	
2	FY-018B	4-20mADC	3	2 +	2 -		✓		✓		" 176Ω	
3	TY-091	4-20mADC	3	3 +	3 -		✓		✓		" 176Ω	
4	TY-104	4-20mADC	3	4 +	4 -		✓		✓		" 176Ω	
5	UJR-201	0-10VDC	3	5 +	5 -			✓		✓	APPROX. 100Ω	
6	UJR-201	0-10VDC	3	6 +	6 -			✓		✓	" 100Ω	
7	FY-007A	0-10VDC	3	7 +	7 -			✓		✓	" 250Ω	①
8	TI-123	0-10VDC	3	8 +	8 -			✓		✓	" 250Ω	

*NOT INCL. CONTROLLER

4. DISCRETE OUTPUTS: ②

	DESTINATION	CONTACT STATUS		CONTROLLER TERMINALS				POWERED BY CONTROLLER			
NO.	TAG NO.	OPEN	CLOSED	TB. NO	NO	C	NC	YES	NO	LEVEL	NOTES
1	TAH-123	ALARM	NORM.	4		1C			✓	24VDC	
2	INTERLOCK	TRIP	NORM	4		2C			✓		③
3	↓	↓	↓	4		3C			✓		④
4	↓	↓	↓	4		4C			✓		⑤
5	↓	↓	↓	4		5C			✓		⑥
6	INTERLOCK	TRIP	NORM	4		6C			✓		⑦
7											

NOTES:
① FY-007A IS INPUT NO. 6 IN UIC-1 (SEE A-0243-S001)
② CONTACTS ARE ALSO TO OPEN ON POWER FAILURE
③ MASTER FUEL TRIP OUTPUT TO ANNUNCIATOR
④ " " " " " TRIP FEEDCHUTE ROTARY VALVE
⑤ " " " " " " TRANSFER CONV NO. 1
⑥ " " " " " " TRANSFER CONV NO. 2
⑦ " " " " " " IGNITION BURNER

ENERGY, MINES & RESOURCES CANADA

A R F B C 134
RESEARCH FACILITY

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SCALE		DATE	
DRAWN	AF	9 NOV 1983	
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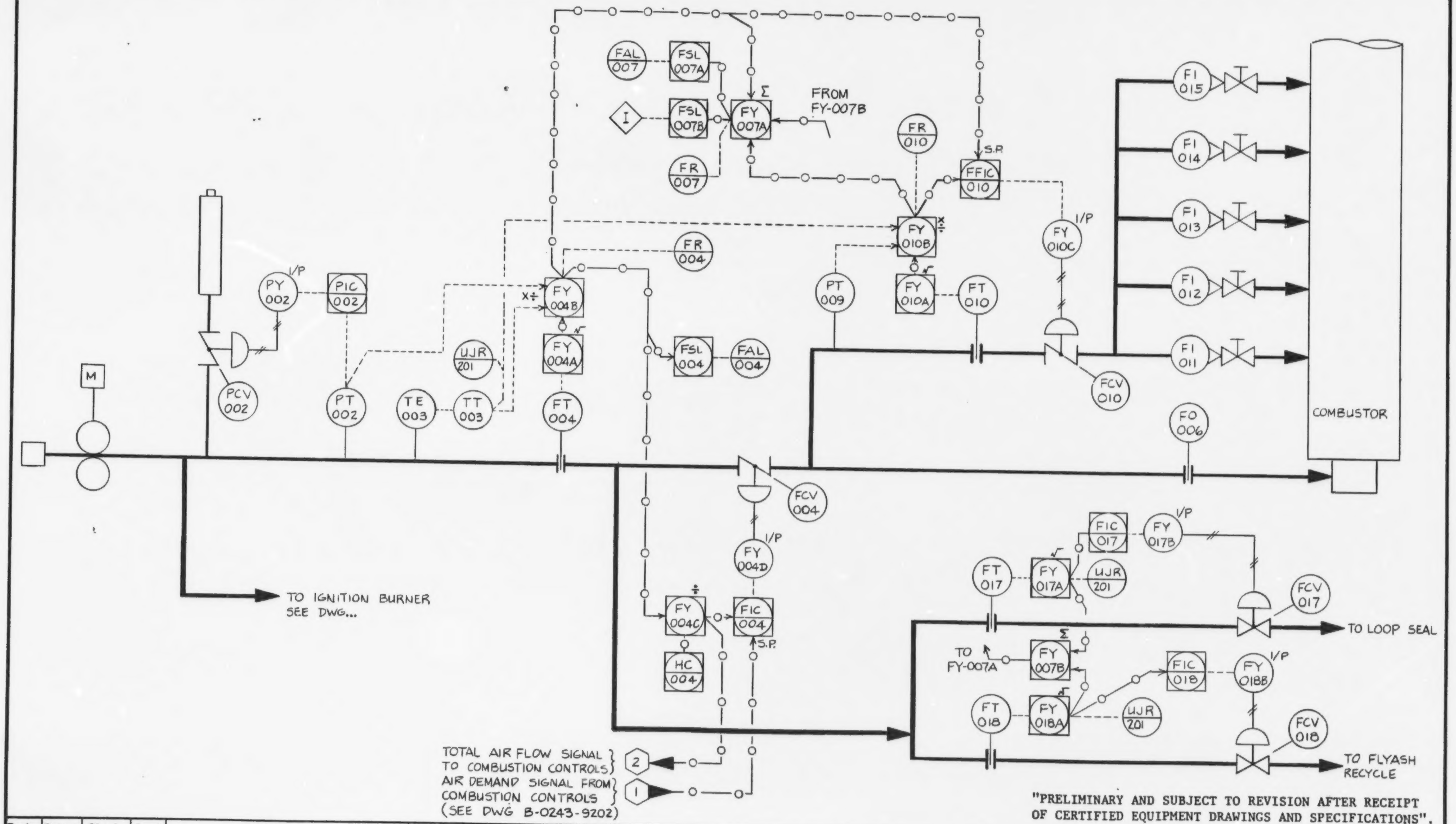
SHARED CONTROLLER I/O LIST - OUTPUTS

A	0243		9006	0


FAL 007
FSL 007A
FSL 007B
I
FY 007A
Σ
FROM FY-007B
FR 007
FR 010
S.P.
FFIC 010
FY 010B
×÷
FY 010C
I/P
FY 010A
√
FT 010
PT 009
FCV 010
FI 015
FI 014
FI 013
FI 012
FI 011
COMBUSTOR
FO 006
FR 004
FY 004B
X÷
FY 004A
√
FT 004
FSL 004
FAL 004
UJR 201
TT 003
TE 003
PT 002
PIC 002
PY 002
I/P
PCV 002
M
FCV 004
FY 004D
I/P
FY 004C
÷
FIC 004
S.P.
HC 004
TO IGNITION BURNER SEE DWG...
TOTAL AIR FLOW SIGNAL TO COMBUSTION CONTROLS
2
AIR DEMAND SIGNAL FROM COMBUSTION CONTROLS (SEE DWG B-0243-9202)
1
FT 017
FY 017A
√
FIC 017
UJR 201
FY 017B
I/P
FCV 017
TO LOOP SEAL
TO FY-007A
FY 007B
Σ
FIC 018
FY 018B
I/P
FT 018
FY 018A
√
UJR 201
FCV 018
TO FLYASH RECYCLE

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Design	Drawn	Check	Appd	Issued for	Date	Rev
A.F.	A.F.	GRC	GRC	INFORMATION	10 Nov 1983	0
				MILESTONE ISSUE	DEC 16/83	0
				FINAL REPORT ISSUE		0

ENERGY, MINES & RESOURCES CANADA
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INSTRUMENT SCHEMATIC
AIR SYSTEM

1136

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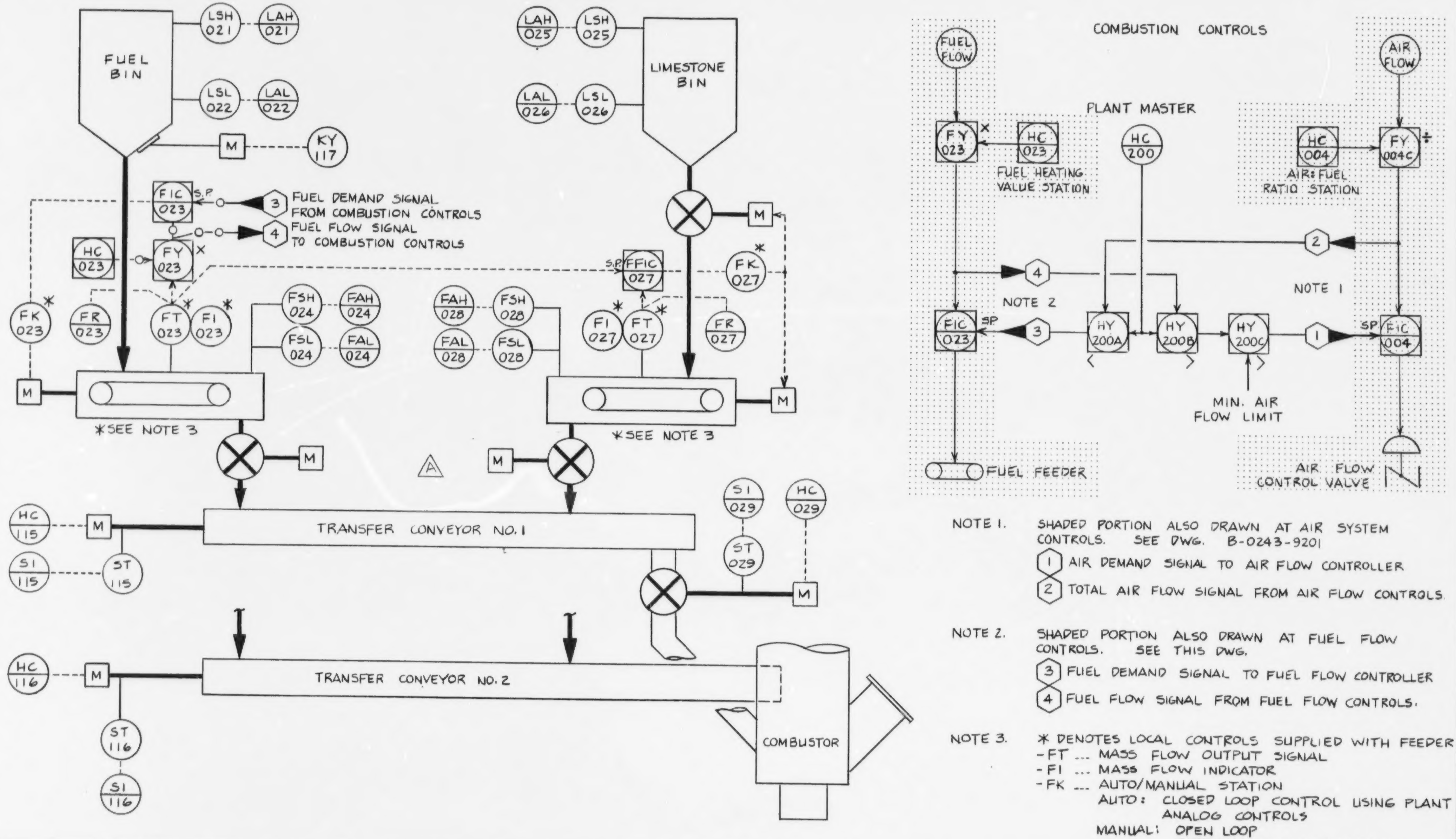
FUEL BIN
LSH 021
LAH 021
LSL 022
LAL 022
M
KY 117
FIC 023
S.P.
3 FUEL DEMAND SIGNAL FROM COMBUSTION CONTROLS
4 FUEL FLOW SIGNAL TO COMBUSTION CONTROLS
HC 023
FY 023 ×
FK 023 *
FR 023
FT 023 *
FI 023 *
FSH 024
FAH 024
FSL 024
FAL 024
M
*SEE NOTE 3
M
A
LIMESTONE BIN
LAH 025
LSH 025
LAL 026
LSL 026
M
S.P. FFIC 027
FK 027 *
FAH 028
FSH 028
FAL 028
FSL 028
FI 027 *
FT 027 *
FR 027
M
*SEE NOTE 3
M
HC 115
M
TRANSFER CONVEYOR NO. 1
SI 115
ST 115
SI 029
HC 029
ST 029
M
HC 116
M
TRANSFER CONVEYOR NO. 2
ST 116
SI 116
COMBUSTOR
COMBUSTION CONTROLS
FUEL FLOW
AIR FLOW
PLANT MASTER
FY 023 ×
HC 023
FUEL HEATING VALUE STATION
HC 200
HC 004
AIR: FUEL RATIO STATION
FY 004C ÷
2
4
NOTE 2
NOTE 1
FIC 023
SP
3
HY 200A <
HY 200B >
HY 200C >
1
SP FIC 004
MIN. AIR FLOW LIMIT
FUEL FEEDER
AIR FLOW CONTROL VALVE

NOTE 1. SHADED PORTION ALSO DRAWN AT AIR SYSTEM CONTROLS. SEE DWG. B-0243-9201

① AIR DEMAND SIGNAL TO AIR FLOW CONTROLLER

② TOTAL AIR FLOW SIGNAL FROM AIR FLOW CONTROLS.

NOTE 2. SHADED PORTION ALSO DRAWN AT FUEL FLOW CONTROLS. SEE THIS DWG.

③ FUEL DEMAND SIGNAL TO FUEL FLOW CONTROLLER

④ FUEL FLOW SIGNAL FROM FUEL FLOW CONTROLS.

NOTE 3. * DENOTES LOCAL CONTROLS SUPPLIED WITH FEEDER.
- FT ... MASS FLOW OUTPUT SIGNAL
- FI ... MASS FLOW INDICATOR
- FK ... AUTO/MANUAL STATION
AUTO: CLOSED LOOP CONTROL USING PLANT ANALOG CONTROLS
MANUAL: OPEN LOOP FEEDER SPEED SET LOCALLY

Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF	GRC	GRC	INFORMATION	10 NOV 1983	0
				MILESTONE ISSUE	DEC 16/83	0
AF	AF			FINAL REPORT ISSUE		A

ENERGY, MINES & RESOURCES
CANADA
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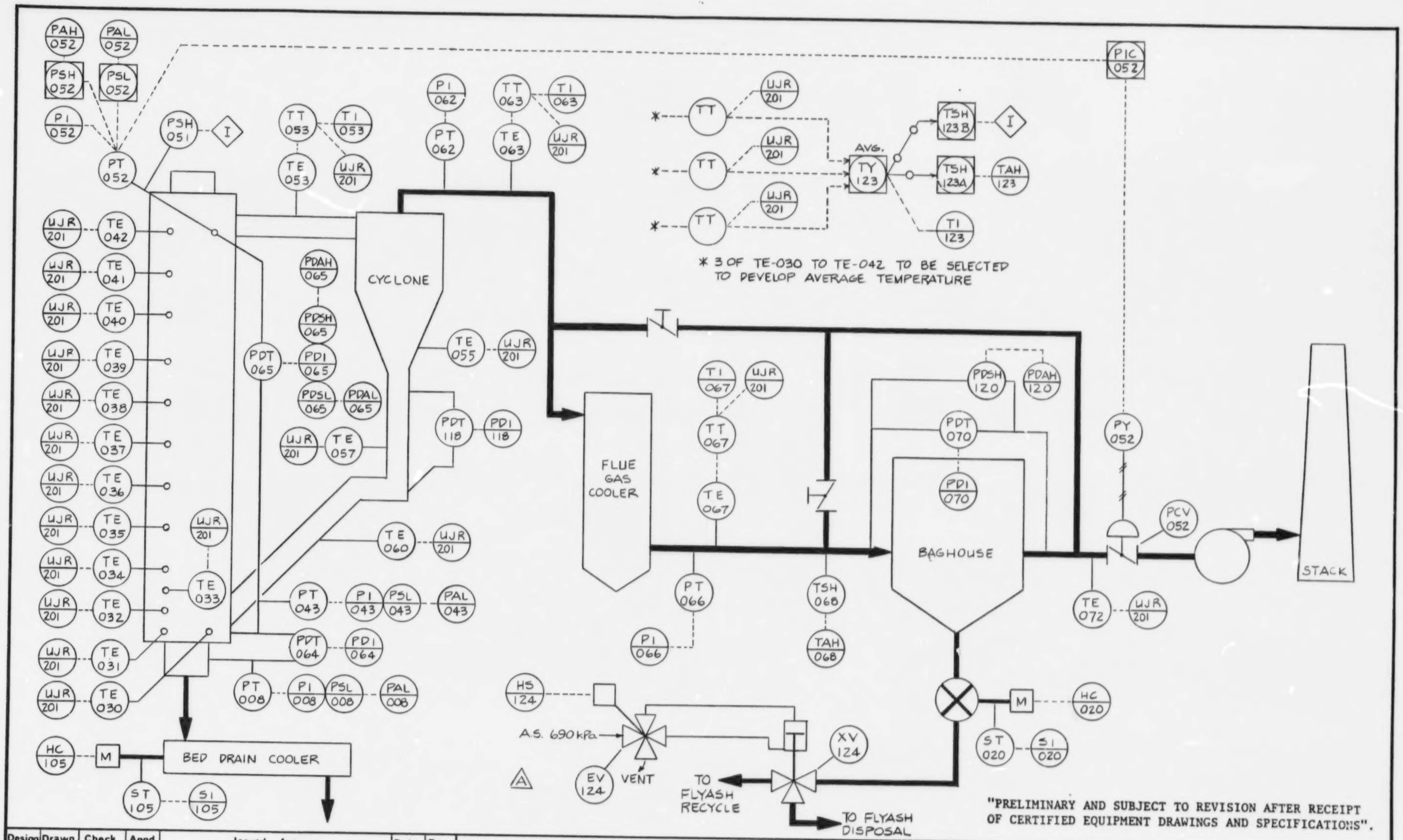
INSTRUMENT SCHEMATIC
FUEL SYSTEM & COMBUSTION CONTROLS

B	0243	9202	A


PAH 052
PAL 052
PSH 052
PSL 052
PI 052
PT 052
PSH 051
I
TT 053
TI 053
TE 053
UJR 201
PI 062
PT 062
TT 063
TI 063
TE 063
UJR 201
TT
TT
TT
UJR 201
UJR 201
UJR 201
AVG.
TY 123
TSH 123B
I
TSH 123A
TAH 123
TI 123
PIC 052
* 3 OF TE-030 TO TE-042 TO BE SELECTED TO DEVELOP AVERAGE TEMPERATURE
UJR 201
TE 042
TE 041
TE 040
TE 039
TE 038
TE 037
TE 036
TE 035
TE 034
TE 033
TE 032
TE 031
TE 030
CYCLONE
PDAH 065
PDSH 065
PDT 065
PDI 065
PDSL 065
PDAL 065
TE 055
UJR 201
UJR 201
TE 057
PDT 118
PDI 118
TE 060
UJR 201
PT 043
PI 043
PSL 043
PAL 043
PDT 064
PDI 064
PT 008
PI 008
PSL 008
PAL 008
FLUE GAS COOLER
TI 067
UJR 201
TT 067
TE 067
PT 066
PI 066
TSH 068
TAH 068
PDSH 120
PDAH 120
PDT 070
PDI 070
BAGHOUSE
PY 052
PCV 052
TE 072
UJR 201
STACK
HS 124
A.S. 690 kPa
EV 124
VENT
XV 124
TO FLYASH RECYCLE
TO FLYASH DISPOSAL
M
HC 020
ST 020
SI 020
HC 105
M
BED DRAIN COOLER
ST 105
SI 105
A

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Design	Drawn	Check	Appd	Issued for	Date	Rev
A.F.	A.F.	GRC	GRC	INFORMATION	10 NOV 1983	0
				MILESTONE ISSUE	DEC 16/83	0
AF	AF			FINAL REPORT ISSUE		A

ENERGY, MINES & RESOURCES
CANADA
ARFBC RESEARCH FACILITY

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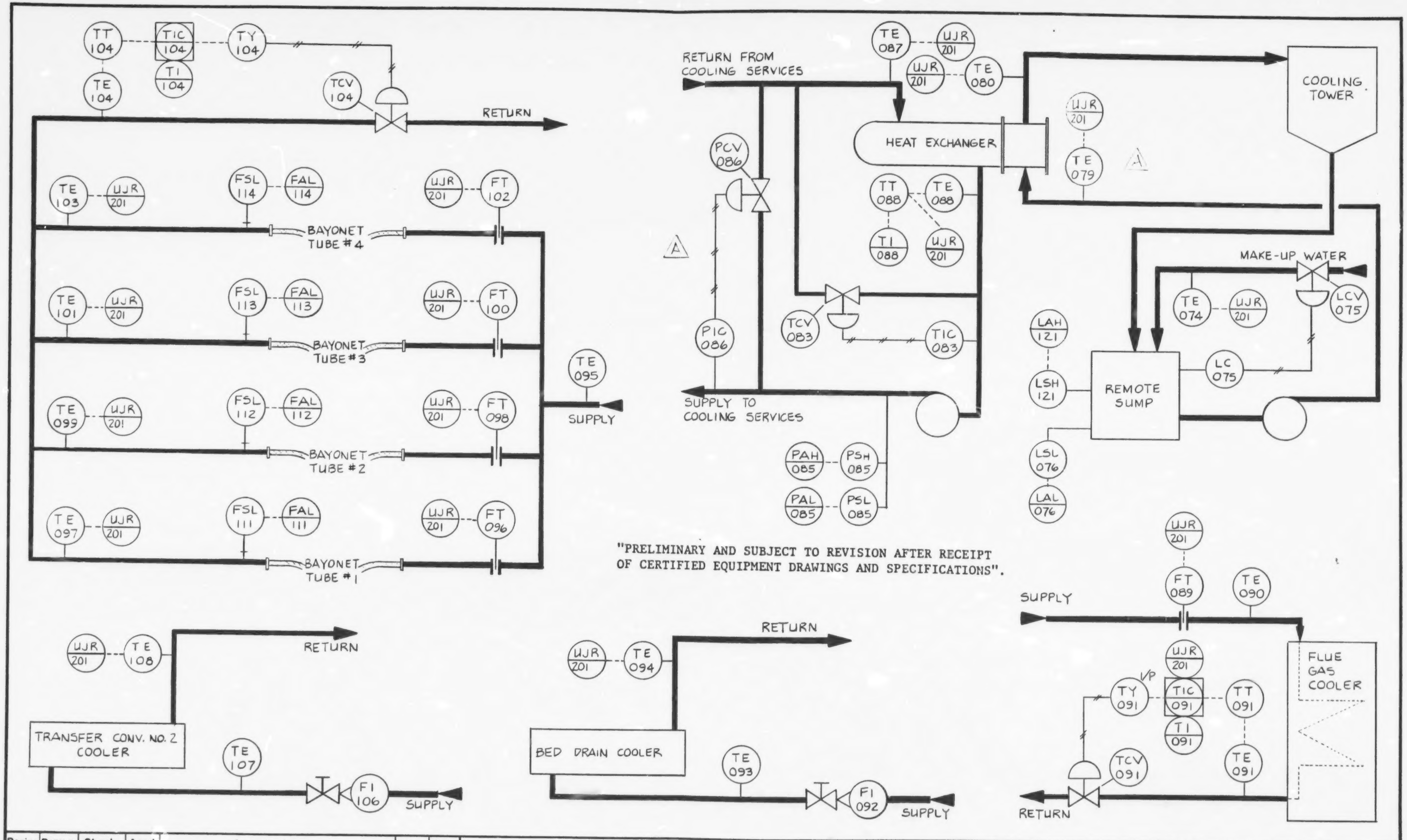
INSTRUMENT SCHEMATIC
COMBUSTOR & FLUE GAS SYSTEM

B | 0243 | 9203 | A


TT 104
TIC 104
TY 104
TE 104
TI 104
TCV 104
RETURN
TE 103
UJR 201
FSL 114
FAL 114
UJR 201
FT 102
BAYONET TUBE #4
TE 101
UJR 201
FSL 113
FAL 113
UJR 201
FT 100
BAYONET TUBE #3
TE 095
SUPPLY
TE 099
UJR 201
FSL 112
FAL 112
UJR 201
FT 098
BAYONET TUBE #2
TE 097
UJR 201
FSL 111
FAL 111
UJR 201
FT 096
BAYONET TUBE #1
RETURN FROM COOLING SERVICES
TE 087
UJR 201
UJR 201
TE 080
COOLING TOWER
PCV 086
HEAT EXCHANGER
UJR 201
TE 079
A
A
TT 088
TE 088
TI 088
UJR 201
MAKE-UP WATER
TCV 083
TIC 083
PIC 086
TE 074
UJR 201
LCV 075
LAH 121
LSH 121
REMOTE SUMP
LC 075
SUPPLY TO COOLING SERVICES
PAH 085
PSH 085
PAL 085
PSL 085
LSL 076
LAL 076
UJR 201
FT 089
TE 090
SUPPLY
UJR 201
FLUE GAS COOLER
I/P
TY 091
TIC 091
TI 091
TT 091
TE 091
TCV 091
RETURN
UJR 201
TE 108
RETURN
TRANSFER CONV. NO. 2 COOLER
TE 107
FI 106
SUPPLY
UJR 201
TE 094
RETURN
BED DRAIN COOLER
TE 093
FI 092
SUPPLY

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF	GRC	GRC	INFORMATION	10 NOV 1983	0
				MILESTONE ISSUE	DEC 16/83	0
AF	AF			FINAL REPORT ISSUE		A

ENERGY, MINES & RESOURCES CANADA
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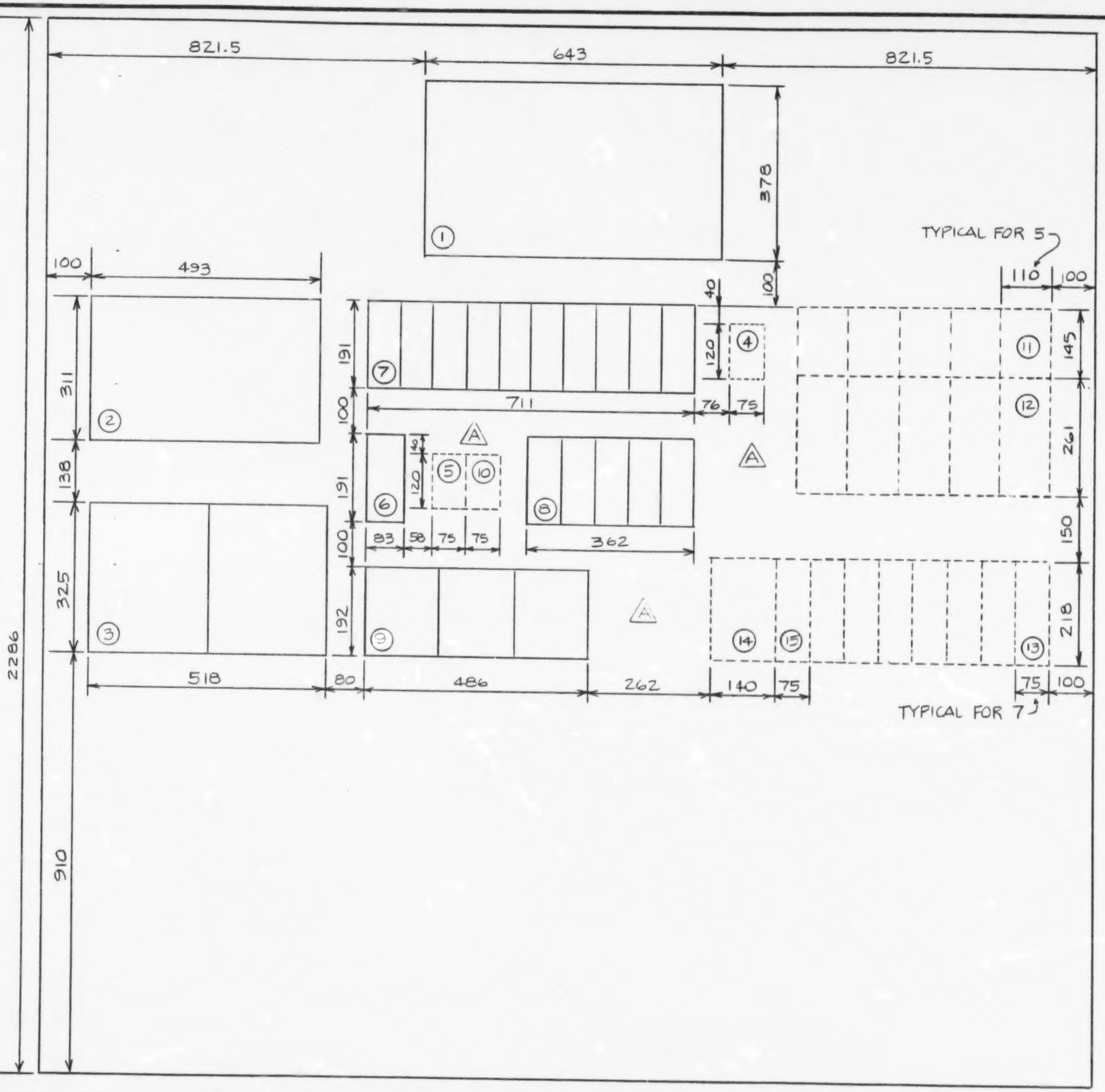
INSTRUMENT SCHEMATIC
PLANT COOLING SYSTEM

B 0243 9204 A


821.5
643
821.5
378
①
100
493
TYPICAL FOR 5
110
100
40
100
311
②
191
⑦
120
④
145
⑪
711
76
75
⑫
100
△A
40
120
⑤
⑩
191
⑥
⑧
△A
261
138
83
58
75
75
362
100
150
325
③
192
⑨
△A
⑭
⑮
⑬
218
2286
518
80
486
262
140
75
75
100
TYPICAL FOR 7
910

* DENOTES ITEMS TO BE SUPPLIED WITH PANEL

ITEM	CUTOUT	RESERVED SPACE	DETAIL	DESCRIPTION
1	X		-	ANNUNCIATOR
2	X		-	DATALOGGER (DIGI-STRIP III)
3	X		-	WEIGHFEEDER REMOTE STATION
4		X	A	ANNUNCIATOR ACK&TEST PUSHBUTTONS
5		X	B	FUEL TRIP PUSHBUTTONS *
6	X			PLANT MASTER SETPOINT HC-200
7	X		-	INSTRUMENT SHELF WITH TEN INDICATORS
8	X		-	INSTRUMENT SHELF WITH FIVE RECORDERS
9	X		-	THREE CONTROLLERS
△A 10		X	G	FUEL TRIP BYPASS KEYSWITCH + LIGHT *
11		X	D	VOLTMETER (SPEED INDICATOR) *
12		X	E	VARIABLE SPEED DRIVE REMOTE STATION
13		X	F	PUSH BUTTON + INDICATING LIGHT STATION *
14		X	C	SELECTOR SWITCH, LIGHT & TIMER STATION *
△A 15		X	H	SEL. SWITCH + LIGHTS STN *

NOTES

1. DETAIL A-F ON B-0243-9402
2. PANEL SHALL BE FREE STANDING, RIGID, TOTALLY ENCLOSED AND SELF SUPPORTING. PANEL SHALL BE FABRICATED OF 10 GAUGE STEEL (14 GA. REAR DOORS C/W GASKETS)
3. PANEL DEPTH 914 mm
4. 1/4" x 1" STIFFENERS SHALL BE PROVIDED AS REQ'D ALONG THE FRONT FACE, TACK WELDED EVERY 150 mm
5. LIFTING EYE-BOLTS (REMOVABE) SHALL BE INCLUDED
6. LAMACOID NAMEPLATES (70mm x 40mm) SHALL BE SUPPLIED AND INSTALLED BENEATH EACH INDICATOR (LEGENDS TO BE ADVISED LATER). NAMEPLATES ALSO SHALL BE SUPPLIED FOR ITEMS 4,5,6,11,13,14,10
7. ALL DIMENSIONS ARE mm.
8. NOTES CONT'D B-0243-9402, 9403

"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF	G2C	G2C	INFORMATION	17NOV 1983	0
				MILESTONE ISSUE	DEC 16/83	0
AF	AF			FINAL REPORT ISSUE		A

ENERGY, MINES & RESOURCES CANADA

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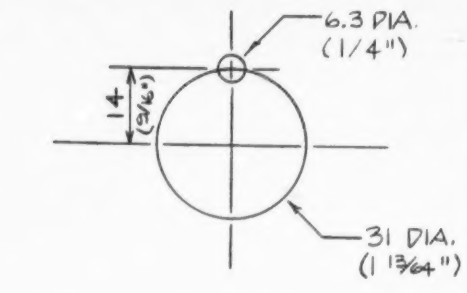
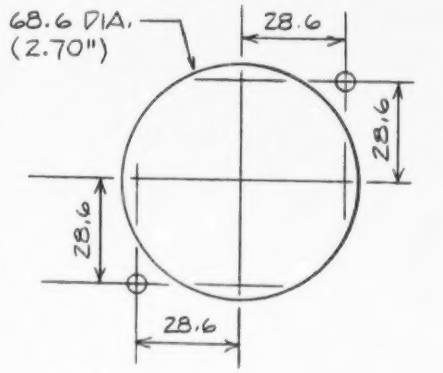
CONTROL PANEL LAYOUT

(LAYOUT)

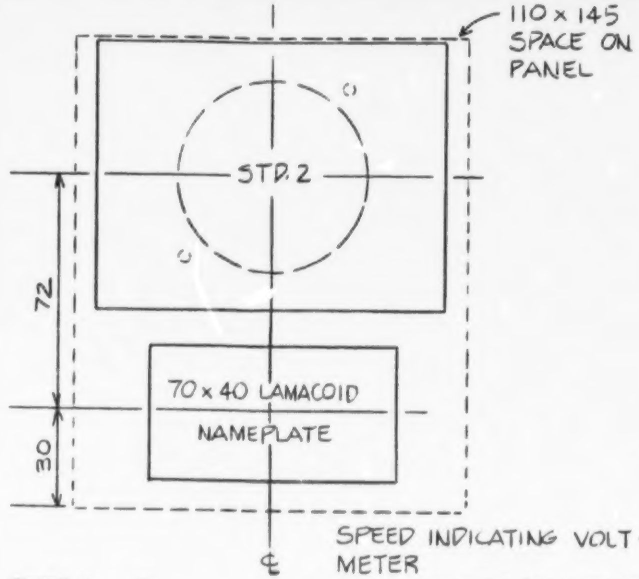
B 0243 9401 A


6.3 DIA.
(1/4")
14
(9/16")
31 DIA.
(1 13/64")

STD. 1 - PUSHBUTTON CUTOUT


68.6 DIA.
(2.70")
28.6
28.6
28.6
28.6

STD. 2 SPEED INDICATING VOLTMETER CUTOUT


110 × 145
SPACE ON
PANEL
STD. 2
72
30
70 × 40 LAMACOID
NAMEPLATE
℄

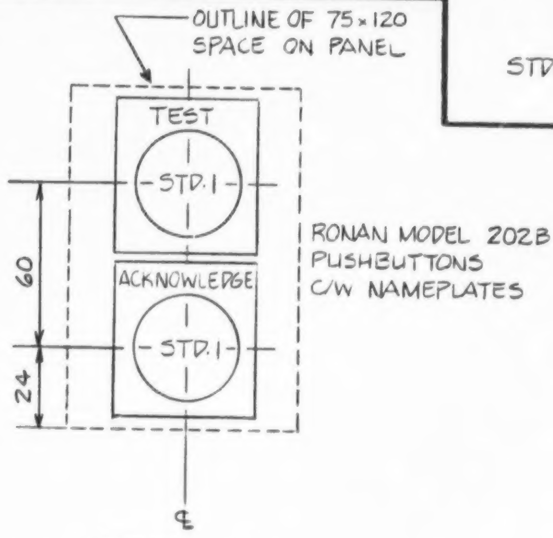
SPEED INDICATING VOLTMETER
G.E. TYPE 255 (3½" FACE)

DETAIL D

NOTES CONT'D:
8. DETAILS OF REAR OF PANEL EQUIPMENT STILL TO BE ADVISED, BUT INCLUDES: ANNUNCIATOR POWER SUPPLY, LOOP POWER SUPPLY AND DISTRIBUTION PANELS, ANALOG NEST.
9. ITEMS 2, 7, 8, 9 REQUIRE REAR SUPPORT.
10. ATC SERIES 342 TIMER (BY OTHERS)
11. NOTES + DETAILS CONT'D B-0243-9403

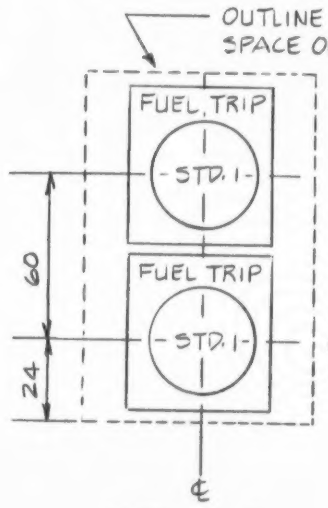
"PRELIMINARY AND SUBJECT TO REVISION AFTER RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

DIMENSIONS IN mm A


OUTLINE OF 75 × 120
SPACE ON PANEL
TEST
STD. 1
ACKNOWLEDGE
STD. 1
60
24
℄

RONAN MODEL 202B PUSHBUTTONS C/W NAMEPLATES

DETAIL A


OUTLINE OF 75×120
SPACE ON PANEL
FUEL TRIP
STD. 1
FUEL TRIP
STD. 1
60
24
℄

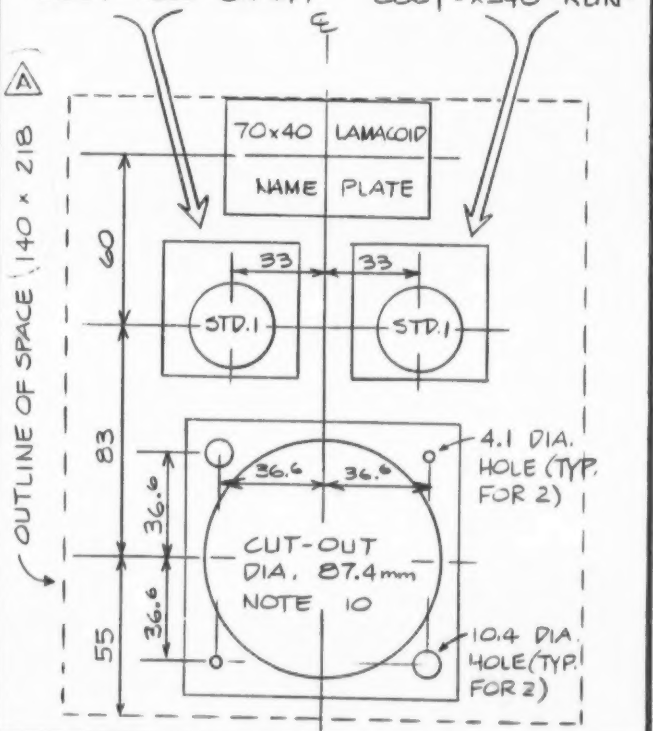
ALLEN-BRADLEY PUSH-PULL SWITCH
PUSH = CONTACTS OPEN (MAINTAINED)
PULL = CONTACTS CLOSED (MAINTAINED)
MODEL 800T-FX6D4 C/W 800T-X621E RED NAMEPLATE "FUEL TRIP"

DETAIL B

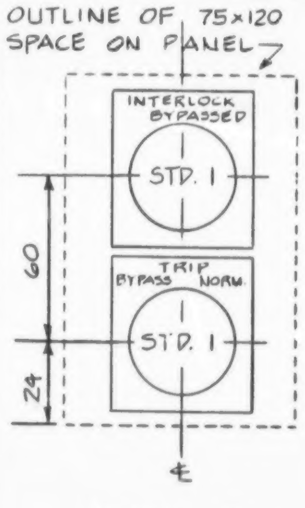
DETAIL C

ALLEN-BRADLEY 2 POSN SELECTOR SWITCH (MAINTAINED) 1 N.O. & 1 N.C. CONTACT 800T-H2A + LEGEND PLATE 800T-X529 "ON-OFF"

ALLEN-BRADLEY TRANSFORMER TYPE PILOT LIGHT 120V 60Hz RED 800T-P16R + LEGEND PLATE 800T-X540 "RUN"


A
OUTLINE OF SPACE 140 × 218
℄
70×40 LAMACOID
NAME PLATE
60
33
33
STD. 1
STD. 1
83
36.6
36.6
36.6
36.6
55
4.1 DIA.
HOLE (TYP.
FOR 2)
CUT-OUT
DIA. 87.4 mm
NOTE 10
10.4 DIA.
HOLE (TYP.
FOR 2)

DETAIL E

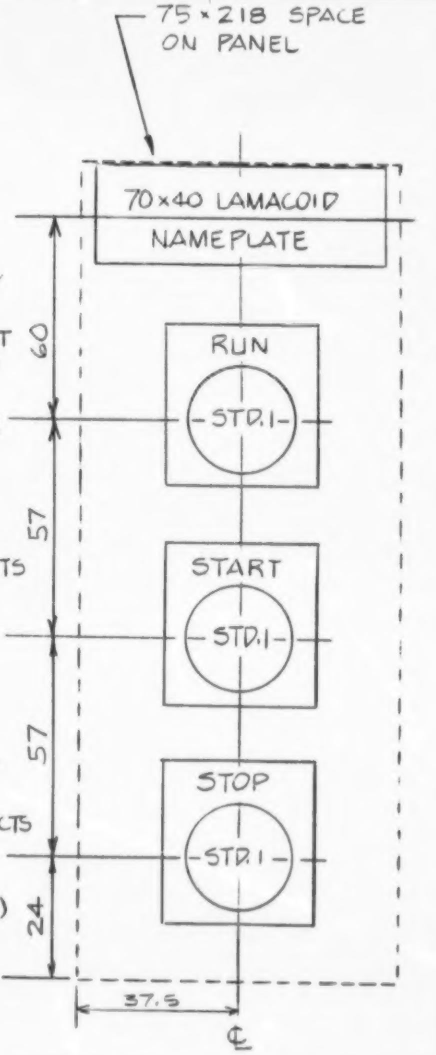

OUTLINE OF 75×120
SPACE ON PANEL
INTERLOCK BYPASSED
STD. 1
TRIP
BYPASS NORM
STD. 1
60
24
℄

ALLEN-BRADLEY TRANSFORMER TYPE FLASHING PILOT LIGHT (RED) 120V 60Hz 800T-PF16R + LEGEND PLATE (RED) 800T-X621E (ENGRAVED AS SHOWN)

KEY SWITCH 800T-H32B 2 N.O. - 2 N.C. CONTACTS (MAINTAINED). KEY WITHDRAWN ONLY IN RIGHT POSN ("NORM") + LEGEND PLATE (RED) 800T-X621E (ENGRAVED AS SHOWN)

DETAIL G A

DETAIL F


75 × 218 SPACE
ON PANEL
70×40 LAMACOID
NAMEPLATE
60
RUN
STD. 1
57
START
STD. 1
57
STOP
STD. 1
24
37.5
℄

ALLEN-BRADLEY TRANSFORMER TYPE PILOT LIGHT 120V 60Hz RED 800T-P16R + LEGEND PLATE 800T-X540

FLUSH HEAD 1NO-1NC CONTACTS BLACK BUTTON 800T-A2A + LEGEND PLATE 800T-X547

MUSHROOM HEAD RED BUTTON 1NO.-1NC CONTACTS 800T-D6A LEGEND PLATE RED - "STOP") 800T-X550

Design	Drawn	Check	Appd	Issued for	Date	Rev
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				MILESTONE ISSUE	DEC 16/83	0
AF	AF			FINAL REPORT ISSUE		A

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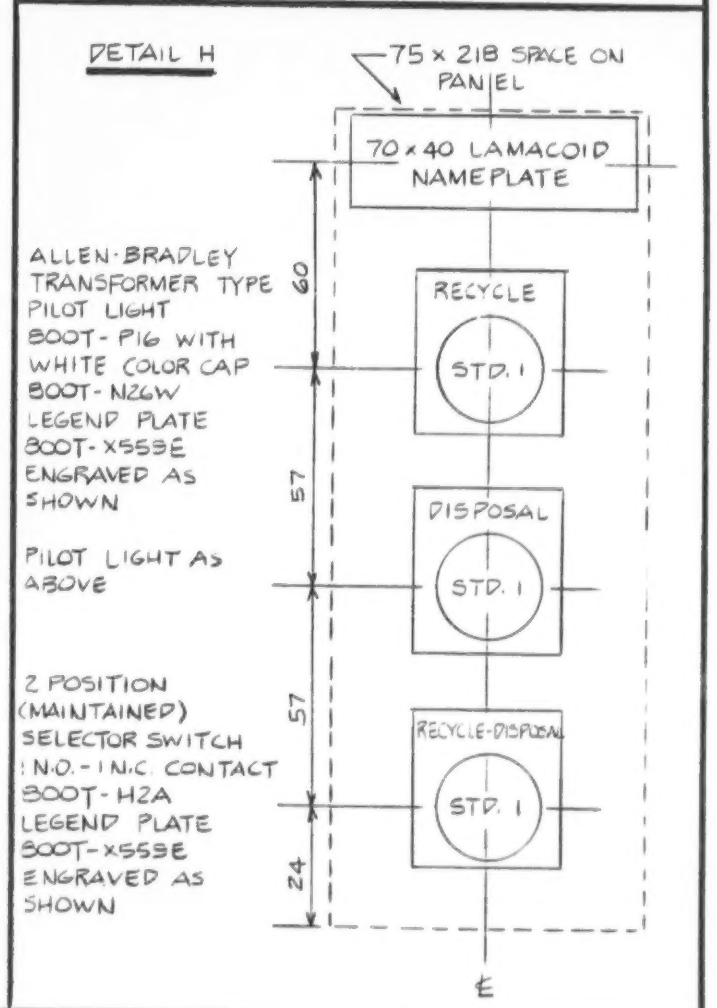
CONTROL PANEL LAYOUT
(DETAILS)

B	0243		9402	A


DETAIL H
75 × 218 SPACE ON PANEL
70 × 40 LAMACOID NAMEPLATE
ALLEN·BRADLEY TRANSFORMER TYPE PILOT LIGHT 800T-P16 WITH WHITE COLOR CAP 800T-N26W LEGEND PLATE 800T-X559E ENGRAVED AS SHOWN
PILOT LIGHT AS ABOVE
2 POSITION (MAINTAINED) SELECTOR SWITCH 1 N.O.-1 N.C. CONTACT 800T-H2A LEGEND PLATE 800T-X559E ENGRAVED AS SHOWN
60
57
57
24
RECYCLE
STD. 1
DISPOSAL
STD. 1
RECYCLE-DISPOSAL
STD. 1
℄

Design	Drawn	Check	Appd	Issued for	Date	Rev
AF	AF			FINAL REPORT ISSUE		0

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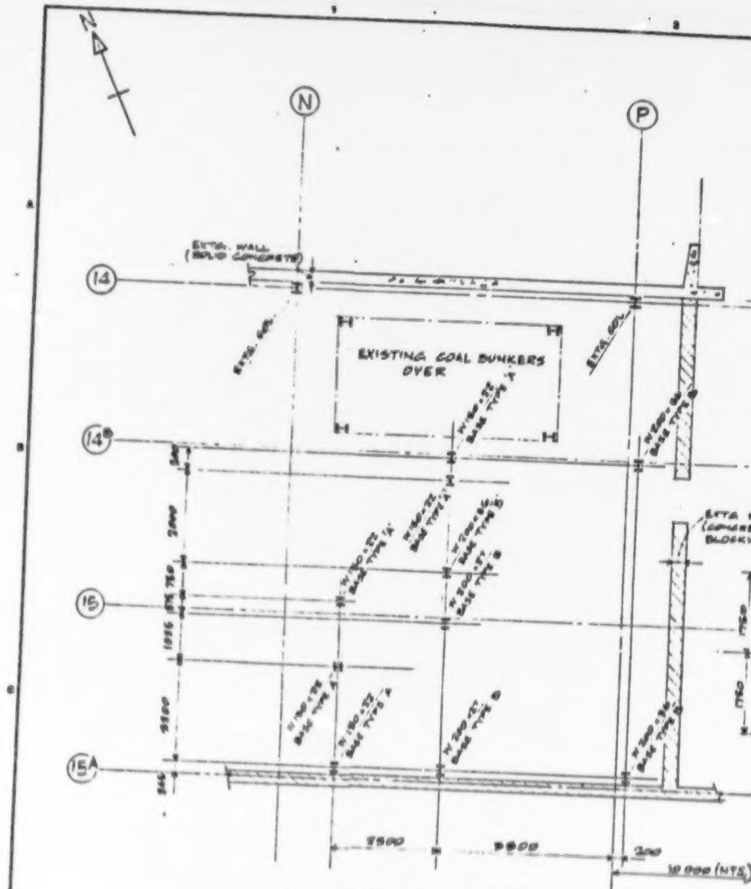
CONTROL PANEL
(DETAILS)

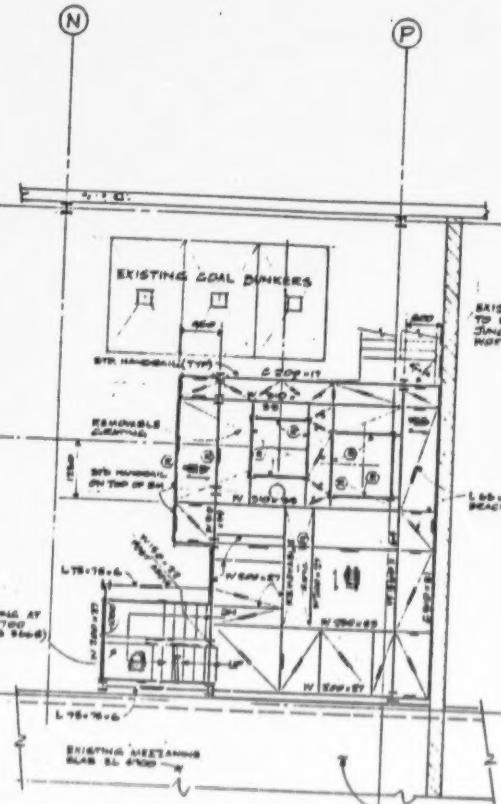
B	0243		9403	0

CIVIL/STRUCTURAL

Civil/Structural


EXTG. WALL (SOLID CONCRETE)
EXISTING COAL BUNKERS OVER
EXTG. WALL (CONCRETE BLOCKWORK)
LANDING AT EL 2300
14
14B
15
15A
N
P
3500
3500
10 000 (NTS)

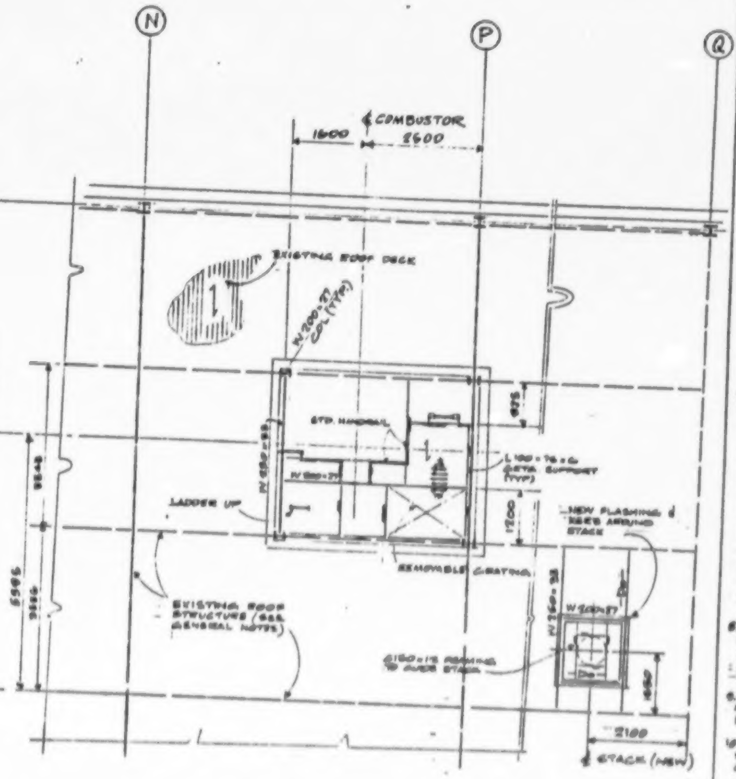
COL. BASE PLAN
U/S B/PL EL -250 UNO


EXISTING COAL BUNKERS
EXISTING LANDING TO BE MODIFIED AT JUNCTION WITH NEW WORK
REMOVABLE GRATING
STD HANDRAIL (TYP)
STD HANDRAIL ON TOP OF BK.
L65×65×6 TYP BRACING (TYP)
EXISTING MEZZANINE SLAB EL 4700
N
P

PLATFORM EL 4700
T.O.S EL 4668

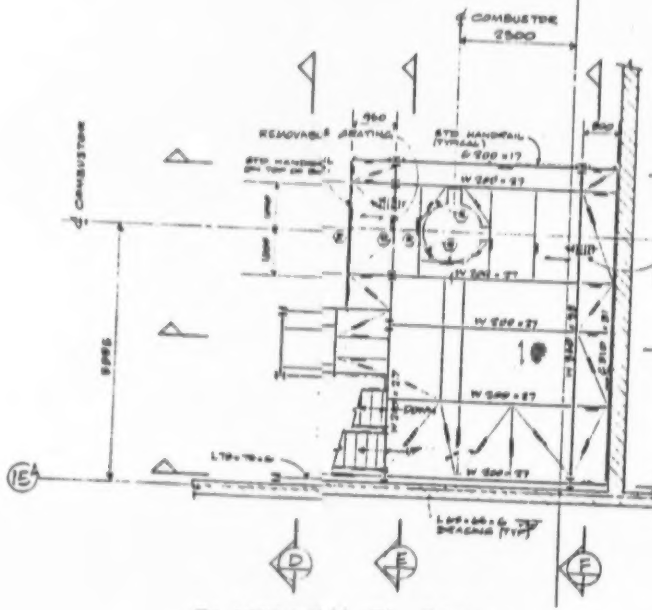
BEAM SIZES (UNLESS SHOWN OTHERWISE ON PLAN)
C150×12 SHOWN AS
W150×37
Ⓡ DENOTES REMOVABLE PLATFORM MEMBERS

STRENGTH OF EXISTING SLAB SHALL BE INVESTIGATED FOR THE SUPPORT OF NEW F.D BLOWER AND LIMESTONE BLOWER (NOT IN PRESENT SCOPE)


℄ COMBUSTOR
1600
2600
EXISTING ROOF DECK
STD HANDRAIL
LADDER UP
REMOVABLE GRATING
NEW FLASHING & KERB AROUND STACK
EXISTING ROOF STRUCTURE (SEE GENERAL NOTES)
2100
℄ STACK (NEW)
N
P
Q

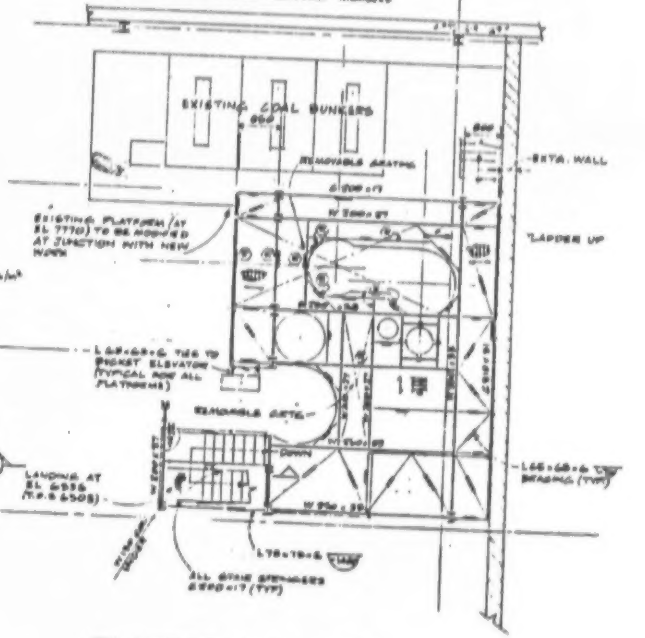
EXTG ROOF
T.O.S EL. 10973

NEW BEAMS C150×12 UNLESS SHOWN OTHERWISE


℄ COMBUSTOR
2500
REMOVABLE GRATING
STD HANDRAIL (TYPICAL)
STD HANDRAIL ON TOP OF BK.
TYPE 50-102 @ 49.4 kN/m² GRATING (TYPICAL)
DOWN
A
B
C
D
E
F
15B

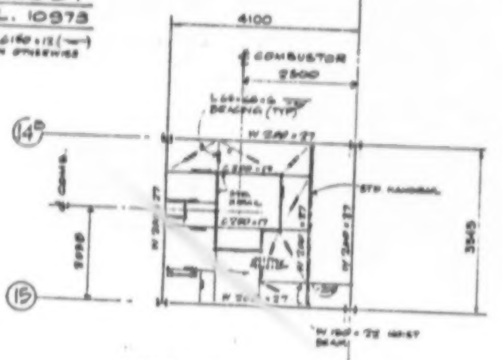
PLATFORM EL. 2300
T.O.S EL 2268

BEAM SIZES (UNLESS SHOWN OTHERWISE ON PLAN)
C150×12 SHOWN AS
W150×37
Ⓡ DENOTES REMOVABLE PLATFORM MEMBERS


EXISTING COAL BUNKERS
REMOVABLE GRATING
EXTG. WALL
LADDER UP
EXISTING PLATFORM AT EL 7770 TO BE MODIFIED AT JUNCTION WITH NEW WORK
REMOVABLE GRTG.
LANDING AT EL 6535 (T.O.S 6505)
L65×65×6 TYP BRACING (TYP)
ALL STAIR STRINGERS C200×17 (TYP)
DOWN
G

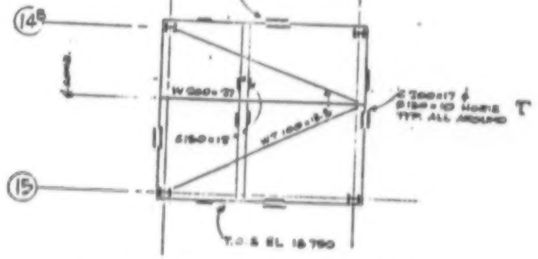
PLATFORM EL 7770
T.O.S EL 7738

BEAM SIZES (UNLESS SHOWN OTHERWISE ON PLAN):
C150×12 SHOWN AS
W150×37
Ⓡ DENOTES REMOVABLE PLATFORM MEMBERS


4100
℄ COMBUSTOR
2500
STD HANDRAIL
14B
15

PENTHOUSE PLATFORM
EL. 14400
T.O.S. EL 14368

BEAMS C150×12 UNLESS SHOWN OTHERWISE


T.O.S EL 16 750
14B
15
T.O.S EL 16 750

PENTHOUSE ROOF PLAN.

"PRELIMINARY AND SUBJECT TO REVISION UPON RECEIPT OF CERTIFIED EQUIPMENT DRAWINGS AND SPECIFICATIONS".

PRELIMINARY ~ NOT FOR CONSTRUCTION

GENERAL NOTES

1. ALL STEELWORK SHALL BE DETAILED AND FABRICATED IN ACCORDANCE WITH C.S.A SPECIFICATION CAN3-S16.1-M78 - LIMIT STATES DESIGN (LATEST EDITION)
2. STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF C.S.A. STANDARD G40.21-M-300W.
3. HIGH STRENGTH BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM STANDARD A325M.
4. ANCHOR BOLTS SHALL CONFORM TO ASTM STANDARD A307 OR A36
5. UNLESS OTHERWISE NOTED, FIELD CONNECTIONS SHALL BE MADE WITH HIGH STRENGTH BOLTS - FRICTION TYPE (UNPAINTED FAYING SURFACES)
6. BEAMS SHALL BE CONNECTED FOR THE FULL CAPACITY OF THE BEAM UNDER U.D.L FOR THE SPAN OF THE BEAM UNLESS OTHERWISE INDICATED. CONNECTIONS OF TENSION OR COMPRESSION MEMBERS SHALL BE DESIGNED FOR THE FORCES SHOWN; WHERE NO FORCES ARE SHOWN THE CONNECTIONS SHALL BE DESIGNED FOR 50% OF THE EFFECTIVE STRENGTH FOR TENSION OR COMPRESSION LOAD OF THE MEMBER. ALL FLOOR BRACING SHALL BE CONCENTRICALLY CONNECTED UNLESS OTHERWISE NOTED
7. ALL SURFACES TO BE PAINTED SHALL BE CLEANED AS SET OUT IN THE LATEST EDITION OF S.S.P.C STANDARD SP6 - 'COMMERCIAL BLAST CLEANING'. SHOP PAINT SHALL CONFORM TO C.I.S.C/CPMA STANDARD 1-73A FOR STEELWORK NOT EXPOSED TO THE WEATHER IN THE FINAL COMPLETE INSTALLATION AND NOT REQUIRING FIELD PAINTING. THE PAINT SHALL BE APPLIED TO PRODUCE A MINIMUM DRY FILM THICKNESS OF 0.05mm PER COAT. THE APPLICATION OF THE PAINT SHALL CONFORM TO THE REQUIREMENTS OF C.S.A STANDARD CAN3-S16.1-M78, AND THE MANUFACTURER'S APPLICATION INSTRUCTIONS. FIELD TOUCH-UP PAINTING SHALL BE THE RESPONSIBILITY OF THE ERECTION CONTRACTOR. PAINT SHALL BE SUPPLIED BY THE FABRICATOR.
8. ALL BOLTS IN AREAS OF VIBRATING EQUIPMENT SHALL HAVE THEIR THREADS DAMAGED BY WELDING END OR CHISEL AFTER FINAL TIGHTENING TO PREVENT NUTS FROM VIBRATING LOOSE.
9. ALL WELDING SHALL CONFORM TO THE REQUIREMENTS OF CSA STANDARD W-59.1 (LATEST EDITION)
10. SHIM PLATES FOR GROUTING SHALL BE SUPPLIED BY THE STEEL ERECTION CONTRACTOR.
11. WHERE IN CONTACT WITH CONCRETE STEEL SHALL BE LEFT UNPAINTED
12. THE STEEL ERECTOR SHALL GROUT ALL STRUCTURAL STEEL BASES WITH EMBECO 636 PREMIXED GROUT TO THE MANUFACTURER'S INSTRUCTIONS.
13. DESIGN LOADS :-
    - SNOW - 2.9 kN/m² ON GROUND
    - WIND - 0.5 kN/m² FOR CLADDING
    - " - 0.37 kN/m² FOR STRUCT. MEMBERS
    - PLATFORM LIVE LOAD - 5 kN/m²
    - EARTHQUAKE - ZONE 2 (A=0.04)
    - ALL STRUCTURES DESIGNED IN ACCORD WITH THE NATIONAL BUILDING CODE OF CANADA.
14. ALL HANDRAIL AND GRATING TO BE FIXED UNLESS NOTED OTHERWISE.
15. UNLESS SHOWN OTHERWISE KICK PLATES 100×6 SHALL BE WELDED TO THE EDGE OF BEAM FLANGES OR GRATING AROUND OPENINGS OR ENDS OF PLATFORM, WHERE NO HANDRAILS ARE SHOWN.
16. ALL EXISTING STRUCTURAL MEMBERS SUPPORTING NEW ADDITIONAL LOADS SHALL BE CHECKED AND REINFORCED AS NECESSARY. THIS WORK IS NOT WITHIN THE PRESENT SCOPE AND HAS NOT BEEN CARRIED OUT BY INTEG.
17. ALL CONCRETE WORK SHALL BE DONE IN ACCORDANCE WITH CSA STANDARD A23.1-M77.
18. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 30 MPa AT 28 DAYS.
19. REINFORCING STEEL SHALL BE GRADE 400 DEFORMED BARS CONFORMING TO CSA STANDARD G30.12-M77 - 'BILLET STEEL BARS FOR CONCRETE REINFORCEMENT'.
20. CONCRETE COVER TO REINFORCING BARS SHALL BE AS FOLLOWS:
    - CAST AGAINST EARTH WITHOUT USE OF FORMS ———— 75mm
    - EXPOSED TO EARTH OR WEATHER ———— 50mm
    - NOT EXPOSED TO EARTH OR WEATHER
      IN SLABS & WALLS ———— 20mm
      IN COLUMNS & BEAMS ———— 40mm
21. FOR DESIGN OF NEW FOUNDATIONS A SAFE BEARING PRESSURE ON THE BEDROCK OF 100 kN/m² HAS BEEN USED
22. THE NOTATION FOR SECTION ARROWS IS AS FOLLOWS:-
    A — SECTION DESIGNATION
    1 — REFERENCE DRAWING ON WHICH SECTION APPEARS OR IS DETAILED

ENERGY, MINES & RESOURCES
CANADA

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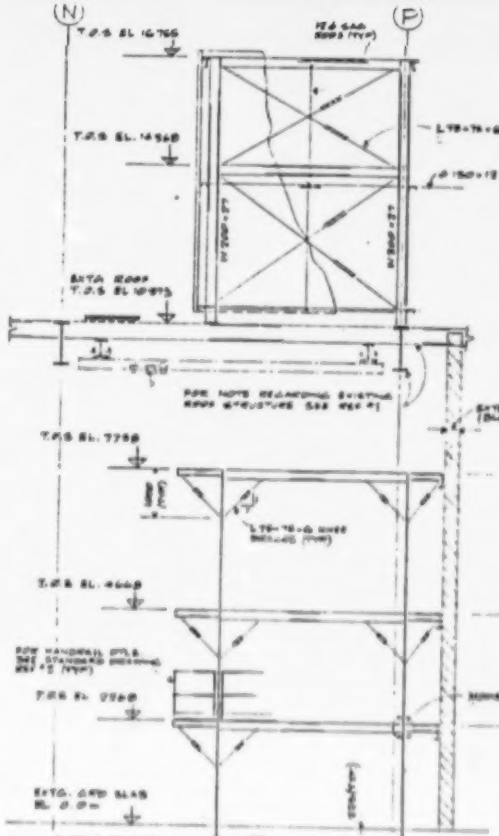
ARFBC RESEARCH FACILITY
STRUCTURAL LAYOUT
PLATFORMS & ROOF PLAN

						Issued For	Date	Rev	Description of Revision
						MILESTONE ISSUE		0	
						FINAL REPORT ISSUE		1	GENERAL

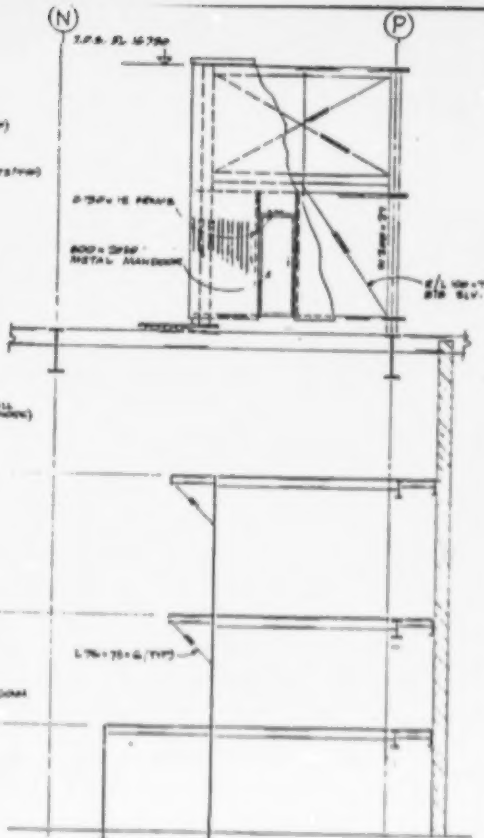
Reference	No.	Dwg. No.
STRUCT'L & ARCH'L ELEV & PLAN	1	A0-245-5003
MISCELLANEOUS DETAILS	2	A0-245-5005
STAIR & HANDRAIL STANDARD	3	A1-000-121-M1500
ANCHOR BOLT STANDARD	4	A1-000-121-M1501

1150

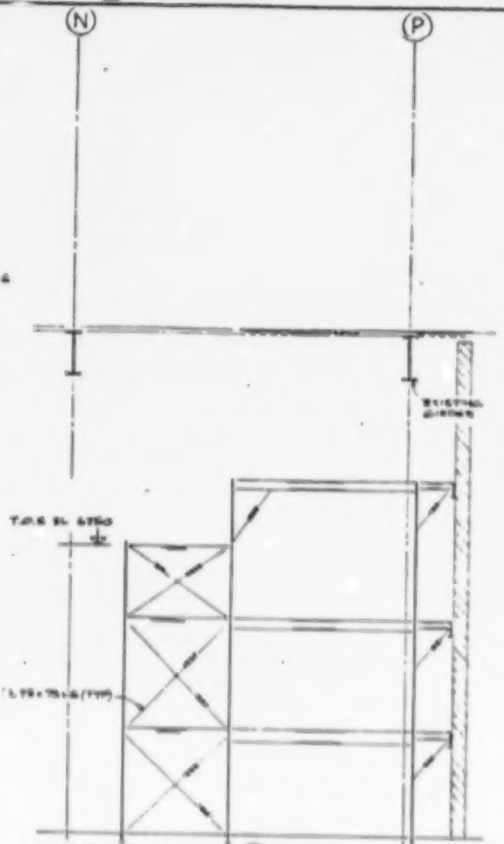
1151


N
P
T.O.S. EL. 16766
T.O.S. EL. 14568
EXTG. ROOF
MOMENT CONN.
EXTG. GRD SLAB
EL 0.0m

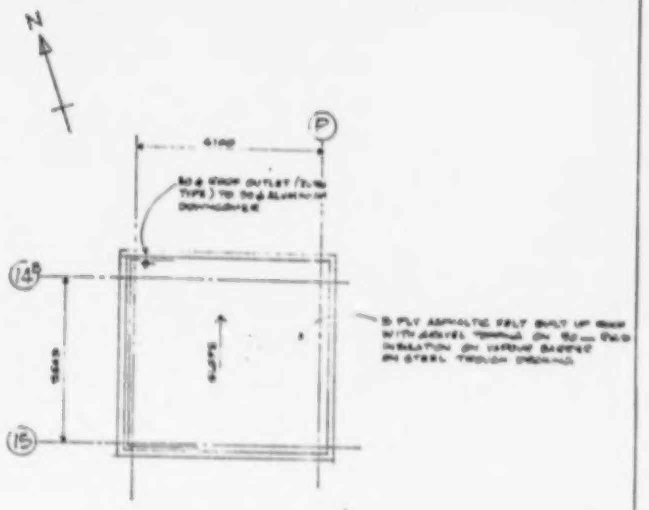
SECTION Ⓐ


N
P
T.O.S. EL 16780
METAL MANDOOR

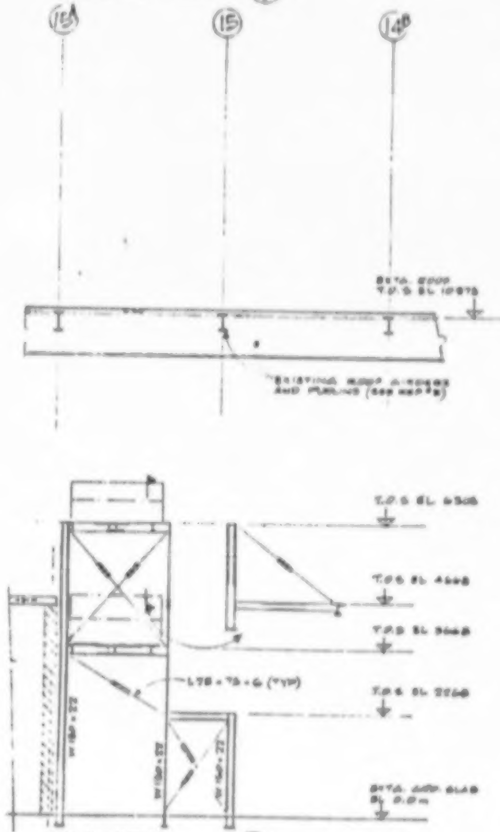
SECTION Ⓑ


N
P
T.O.S. EL 6560

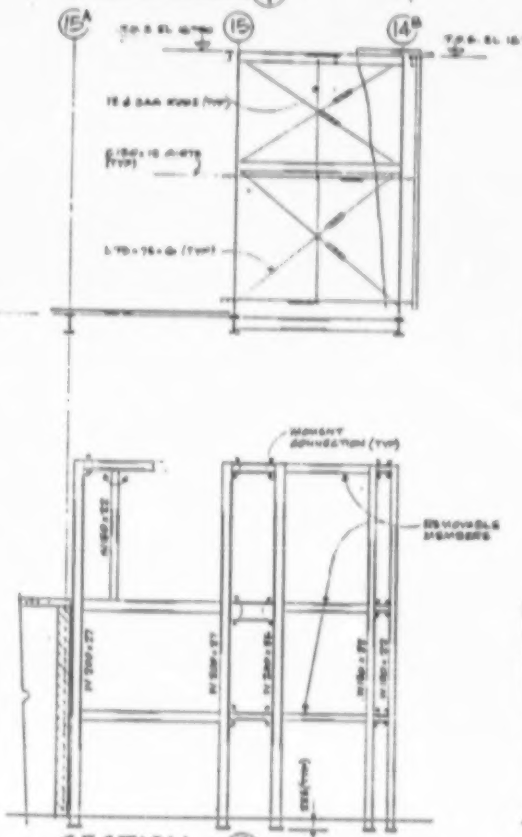
SECTION Ⓒ



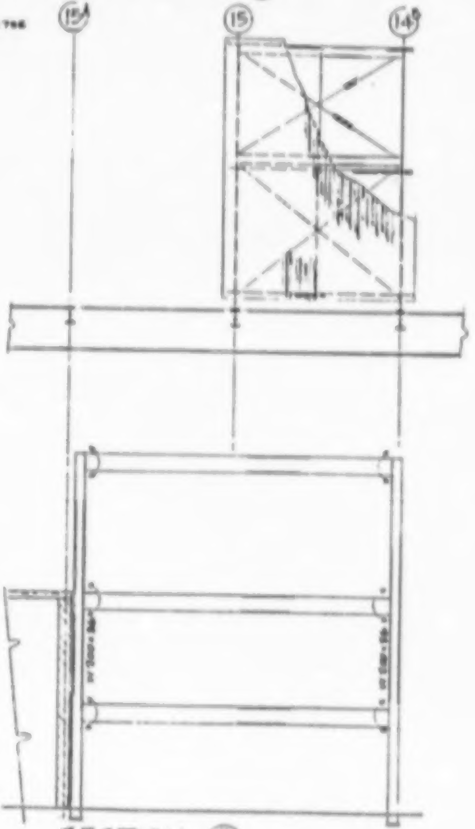
ARCH'L. ROOF PLAN


15A
15
14B
EXISTING ROOF GIRDERS AND PURLINS
T.O.S. EL 6568
T.O.S. EL 4668
T.O.S. EL 2568
EXTG. GRD SLAB EL 0.0m

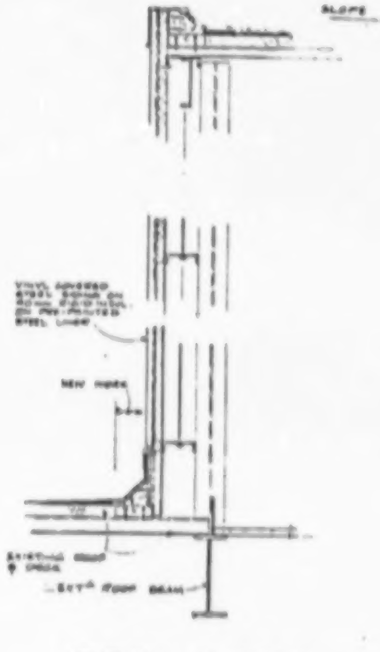
SECTION Ⓓ


15A
15
14B
MOMENT CONNECTION (TYP)
REMOVABLE MEMBERS

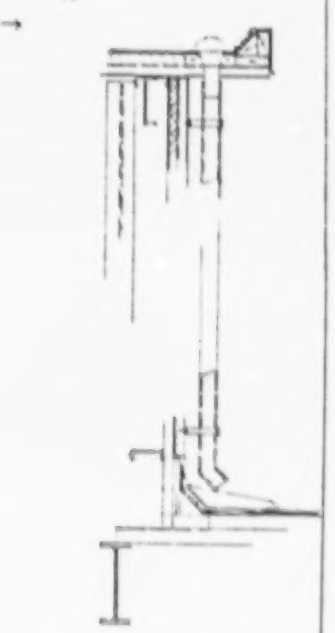
SECTION Ⓔ



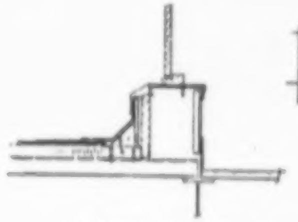
SECTION Ⓕ



TYPICAL PENTHOUSE WALL



DETAIL AT PENTHOUSE NORTH WALL



DETAIL AT PENTHOUSE DOOR THRESHOLD

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CANADA

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ARFBC RESEARCH FACILITY
STRUCTURAL & ARCHITECT'L
ELEVATIONS & DETAILS

70

315

0249

MILESTONE ISSUE

FINAL REPORT ISSUE

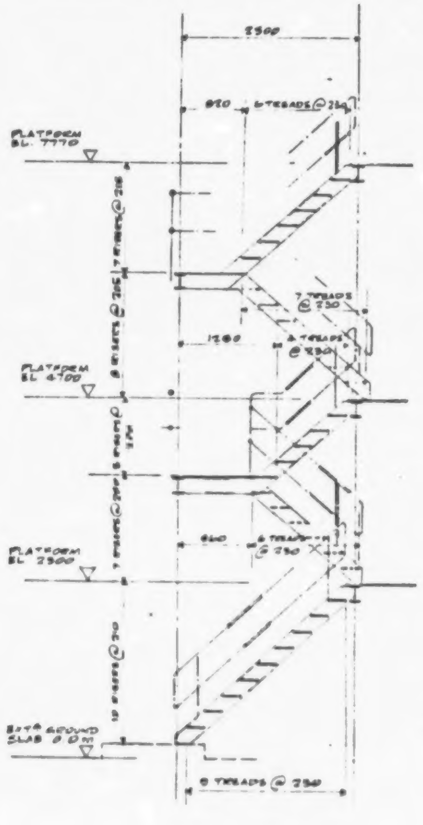
GENERAL

STRUCTURAL LAYOUT

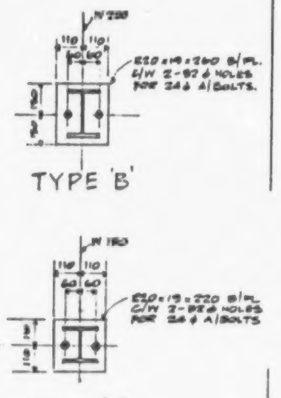
STAIR & HANDRAIL STANDARD

ROOF FRAMING PLAN (DEPT OF PUBLIC WORKS CANADA)

1152


2500
PLATFORM EL 7770
PLATFORM EL 4700
PLATFORM EL 2300
EXIST'G GROUND SLAB ± 0 mm
9 TREADS @ 250
6 TREADS @ 250
7 TREADS @ 250
1280

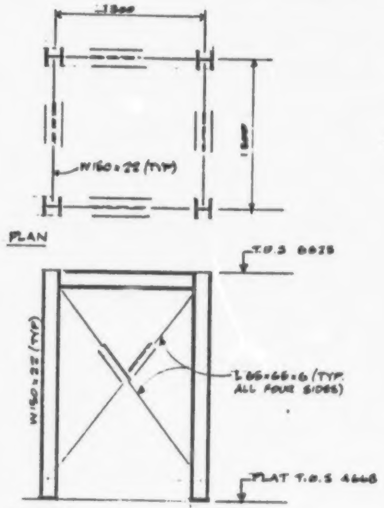
SECTION 4/1
1:50


W 200
220×19×260 B/PL. c/w 2-27 φ HOLES FOR 24 φ A/BOLTS.
W 150
220×19×220 B/PL. c/w 2-27 φ HOLES FOR 24 φ A/BOLTS

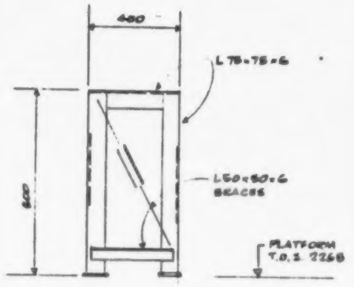
TYPE 'B'

TYPE 'A'

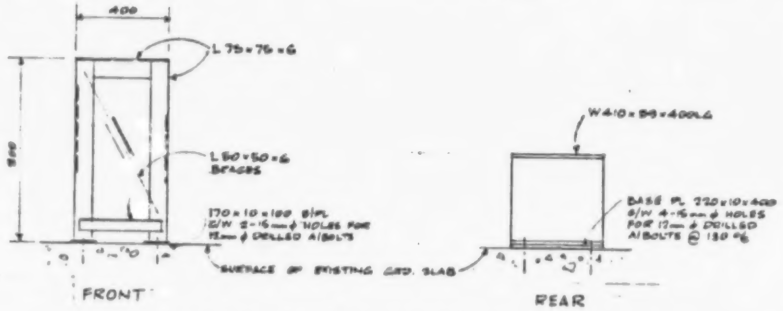
COL. BASE DETAILS
1:10


1300
PLAN
W150×22 (TYP)
T.O.S 8825
L 65×65×6 (TYP. ALL FOUR SIDES)
PLAT T.O.S 4668
ELEVN

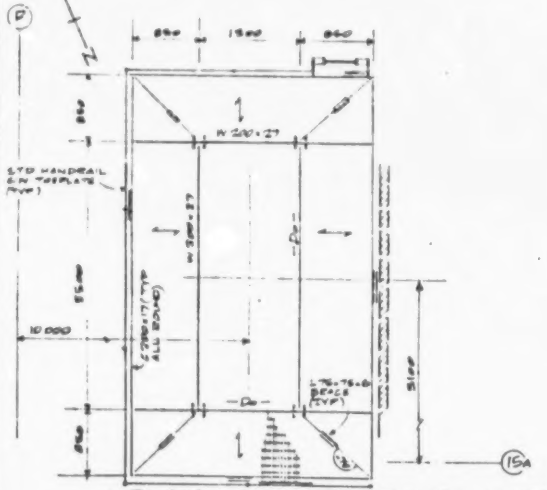
COMBUSTOR SUPPORT 1:20
(CYCLONE SUPPT. SIM.)


400
L 75×75×6
L50×50×6 BRACES
PLATFORM T.O.S 2268

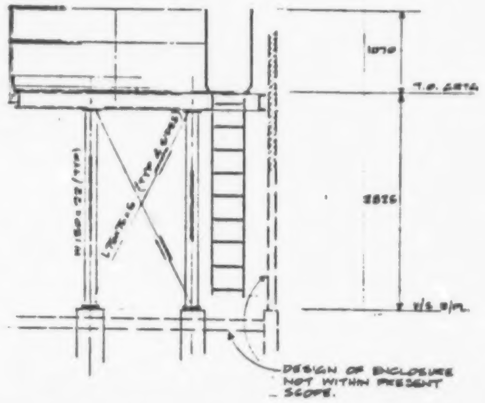
TRANSFER CONVR SUPPT (2-REQD)
1:10


400
L 75×75×6
L50×50×6 BRACES
170×10×100 B/PL c/w 2-16 mm φ HOLES FOR 12 mm φ DRILLED A/BOLTS
SURFACE OF EXISTING GRD. SLAB
W410×39×400LG
BASE PL 220×10×400 c/w 4-16 mm φ HOLES FOR 12 mm φ DRILLED A/BOLTS @ 130 c/c
FRONT
REAR

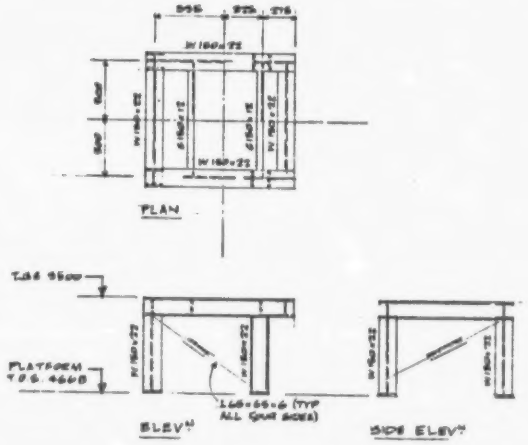
BED DRAIN COOLER / CONVR SUPPORTS
1:10


850
1300
850
W 200×27
STD HANDRAIL c/w TOEPLATE (TYP)
10 000
L 75×75×6 BRACE (TYP)
15A

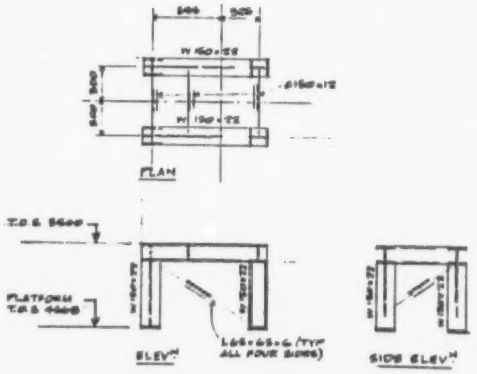
PLAN ~ COOLING TOWER SUPPORT
T.O.S EL 2968
1:30


1070
T.O. 2968
2826
U/S B/PL
DESIGN OF ENCLOSURE NOT WITHIN PRESENT SCOPE.

SIDE ELEV.


T.O.S 5500
PLAN
PLATFORM T.O.S 4668
L65×65×6 (TYP ALL FOUR SIDES)
ELEVN
SIDE ELEVN

FUEL BIN SUPPORT
1:20


T.O.S 5500
PLAN
PLATFORM T.O.S 4668
L65×65×6 (TYP ALL FOUR SIDES)
ELEVN
SIDE ELEVN

LIMESTONE BIN SUPPORT
1:20

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Vancouver
Edmonton
Calgary

ARFBC RESEARCH FACILITY
STRUCTURAL
MISCELLANEOUS DETAILS

V.P.	TDS	LWG		U.L.M	GWG	MILESTONE ISSUE	[illegible]	0	
TDS	TDS				LWG	FINAL REPORT ISSUE	[illegible]	1	GENERAL

Reference	No	Dwg No.
STRUCTURAL LAYOUT	1	A0-243-8801
STAIR & HANDRAIL STD	2	A1-8801-181-MI803

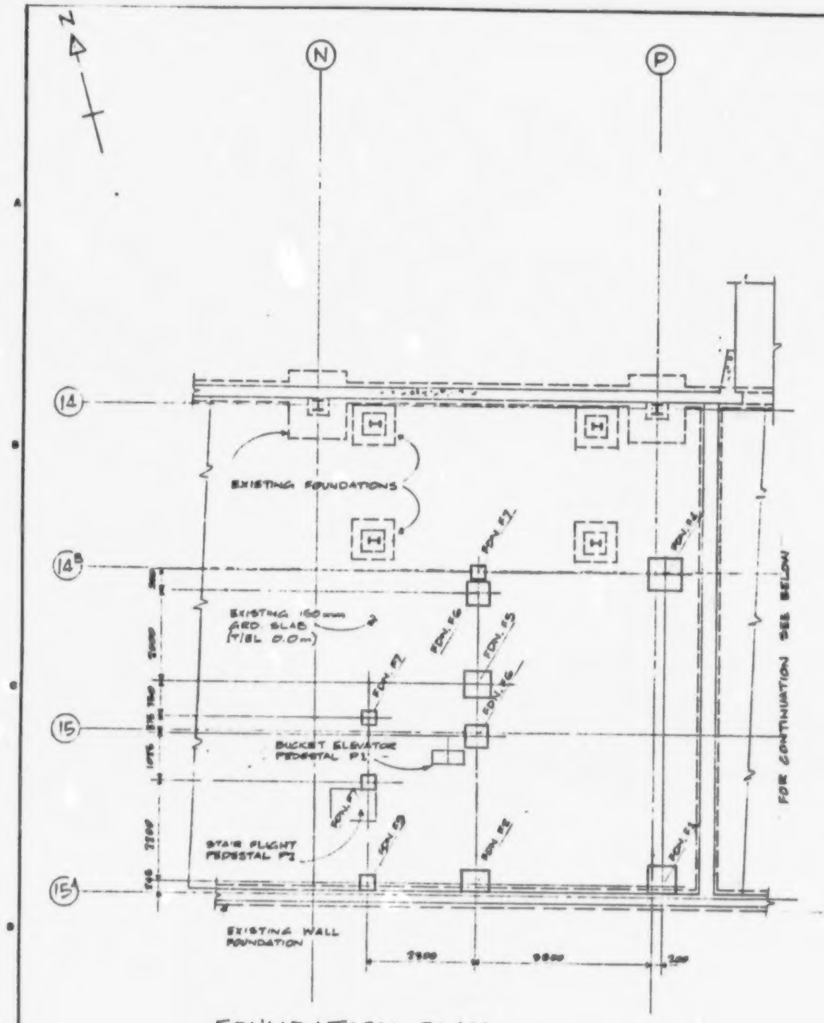
Scale AS NOTED

Drawn TDS

1155

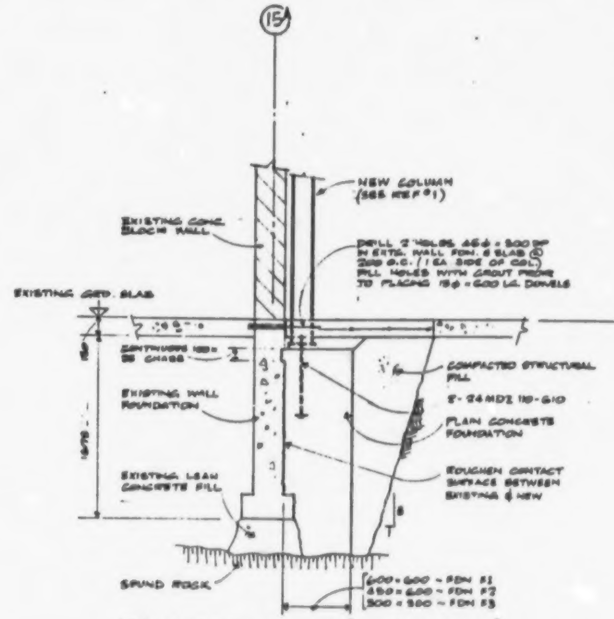
Dwg No. A0 0243 3803 1

154


N
P
14
14B
15
15A
EXISTING FOUNDATIONS
EXISTING 150mm GRD SLAB (T/EL 0.0m)
FDN F7
FDN F4
FDN F6
FDN F5
FDN F6
FDN F2
BUCKET ELEVATOR PEDESTAL P1
STAIR FLIGHT PEDESTAL P2
FDN F3
FDN F3
FDN F1
EXISTING WALL FOUNDATION
FOR CONTINUATION SEE BELOW
2100
2200
7800
9800
200

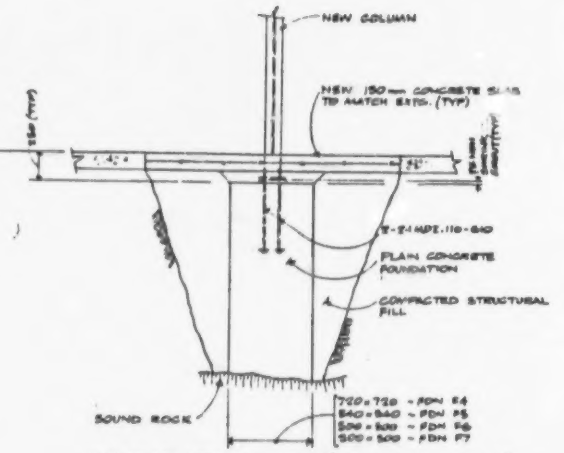
FOUNDATION PLAN

1:50


15A
NEW COLUMN (SEE REF #1)
EXISTING CONC. BLOCK WALL
DRILL 2 HOLES 25φ × 300 DP IN EXTG. WALL FDN. & SLAB @ 200 O.C. (1 EA. SIDE OF COL.) FILL HOLES WITH GROUT PRIOR TO PLACING 15φ × 600 LG. DOWELS
EXISTING GRD. SLAB
CONTINUOUS 100 × 25 CHASE
EXISTING WALL FOUNDATION
COMPACTED STRUCTURAL FILL
2-24MDZ 110-610
PLAIN CONCRETE FOUNDATION
EXISTING LEAN CONCRETE FILL
ROUGHEN CONTACT SURFACE BETWEEN EXISTING & NEW
SOUND ROCK
600 × 600 ~ FDN F1
450 × 600 ~ FDN F2
300 × 300 ~ FDN F3

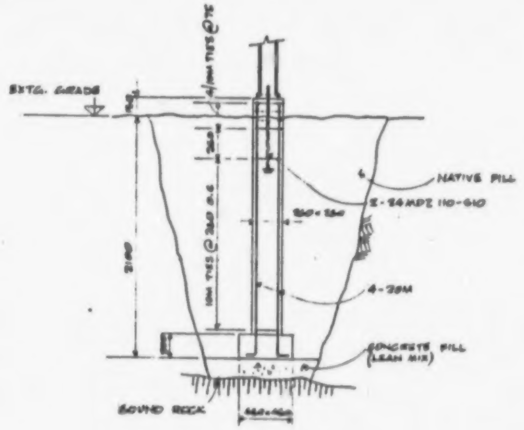
FOUNDATION F1 (F2 & F3 SIM.)

1:20


NEW COLUMN
NEW 150mm CONCRETE SLAB TO MATCH EXTG. (TYP)
2-24MDZ 110-610
PLAIN CONCRETE FOUNDATION
COMPACTED STRUCTURAL FILL
SOUND ROCK
720 × 720 ~ FDN F4
840 × 840 ~ FDN F5
500 × 500 ~ FDN F6
300 × 300 ~ FDN F7

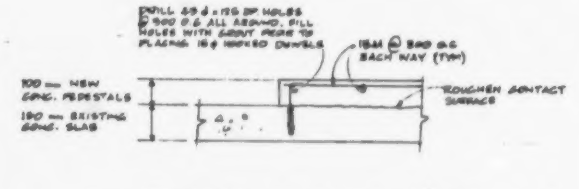
FOUNDATION F4 (F5, F6, F7 SIM.)

1:20

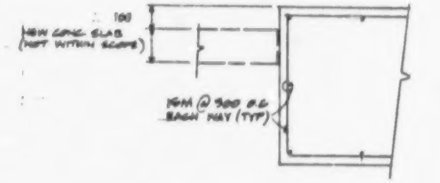

EXTG. GRADE
NATIVE FILL
2-24MDZ 110-610
4-20M
CONCRETE FILL (LEAN MIX)
SOUND ROCK
10M TIES @ 300 O.C.
2100

FOUNDATION F8

1:20


DRILL 25φ × 125 DP HOLES @ 300 O.C. ALL AROUND. FILL HOLES WITH GROUT PRIOR TO PLACING 15φ 100×50 DOWELS
15M @ 300 O.C. EACH WAY (TYP)
100mm NEW CONC. PEDESTALS
150mm EXISTING CONC. SLAB
ROUGHEN CONTACT SURFACE

TYPICAL PEDESTAL DETAIL 1:10
(P1, P2.)


100
NEW CONC. SLAB (NOT WITHIN SCOPE)
15M @ 300 O.C. EACH WAY (TYP)

TYPICAL PEDESTAL DETAIL 1:10
(P3, P4, P5)

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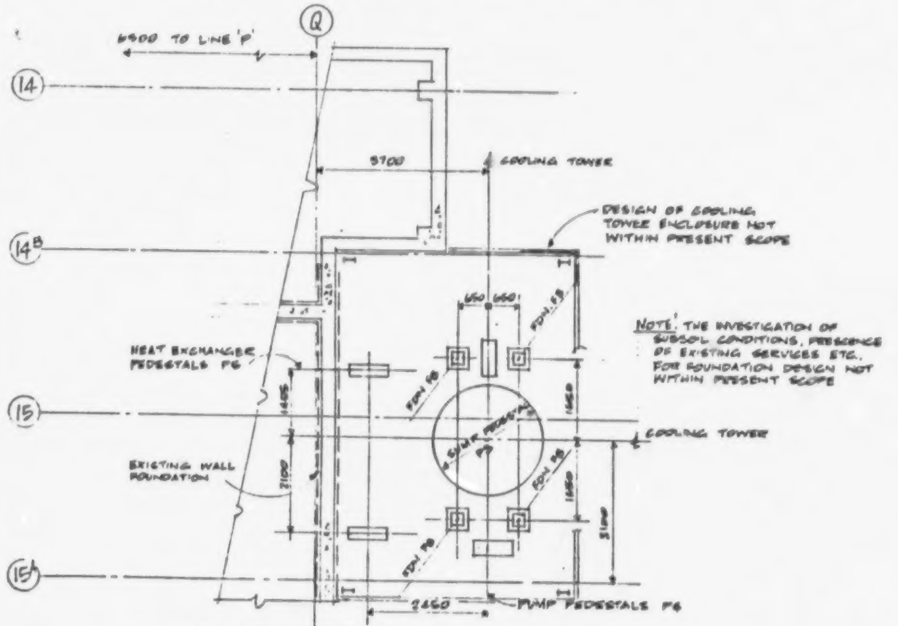
Q
14
14B
15
15A
6900 TO LINE 'P'
5700
COOLING TOWER
DESIGN OF COOLING TOWER ENCLOSURE NOT WITHIN PRESENT SCOPE
650 650
FDN F5
HEAT EXCHANGER PEDESTALS F6
FDN F6
STAIR PEDESTAL P3
FDN F6
COOLING TOWER
EXISTING WALL FOUNDATION
FDN F6
2100
1650
1650
3100
2460
PUMP PEDESTALS F6

NOTE: THE INVESTIGATION OF SUBSOIL CONDITIONS, PRESENCE OF EXISTING SERVICES ETC. FOR FOUNDATION DESIGN NOT WITHIN PRESENT SCOPE

FOUNDATION PLAN

1:60

Design	Drawn	Check		Approval		Issued For	Date	Rev	Description of Revision
LMC		LMC			AC	MILESTONE ISSUE	16 DEC	0	
TDS	TDS					FINAL REPORT ISSUE	31 AUG	1	GENERAL

Reference	No.	Dwg No.
STRUCTURAL LAYOUT	1	0243-5801
ANCHOR BOLT STANDARD	2	A1-0001-MGI-5502

Scale 1:50, 1:20, 1:10

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FOUNDATION PLAN & DTLS.

1157

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1156

POOR

QUALITY

ORIGINAL